



**Massachusetts Bay
Transportation Authority**

**OVERHAUL OF TWO (2)
149-PASSENGER
SUBCHAPTER “T” FERRIES**

TECHNICAL PROVISIONS NO. RROPS20-01

massDOT
Massachusetts Department of Transportation

TABLE OF CONTENTS

000. GENERAL PROVISIONS.....	1
001 INTRODUCTION AND GENERAL SCOPE	1
001.1 TASK LIST - FOR GENERAL GUIDANCE ONLY.....	1
002 GLOSSARY	5
002.1 ABBREVIATIONS	5
002.2 EXPANDED DEFINITIONS	10
002.3 REMOVALS	13
002.4 INSTALLATIONS	14
003 REGULATIONS, DOCUMENTATION, CERTIFICATION	14
003.1 COMPLIANCE	14
003.2 DOCUMENTATION.....	15
003.3 CERTIFICATION.....	15
004 GENERAL SPECIFICATION REQUIREMENTS.....	17
004.1 GENERAL.....	17
004.2 GENERAL VESSEL DESCRIPTION.....	17
004.4 ADA/PVAG REQUIREMENTS.....	18
004.5 CONTRACTOR'S OBLIGATION.....	20
004.6 MANUFACTURERS' REPRESENTATIVES	21
005 CORRESPONDENCE & COMMUNICATIONS	21
006 DOCUMENTATION	22
006.1 PROPOSAL DRAWINGS	22
006.2 CONTRACT DRAWINGS	22
006.3 REQUIRED DRAWINGS AND DOCUMENTS	23
006.4 INTERFERENCE & ACCESS	27
006.5 ENGINEERING	27
006.6 AS-BUILT DRAWINGS	28
006.7 MANUALS AND MAINTENANCE INSTRUCTIONS	28
006.8 VESSEL HISTORY BOOKS.....	29
006.9 PHOTOGRAPHS.....	29
006.10 MASTER CONSTRUCTION SCHEDULE AND PROGRESS UPDATES	30
006.11 EQUIPMENT LIST	32
007 DRAWING REVIEW PROCESS	32
007.1 OVERVIEW.....	32
007.2 DESIGN PACKAGES	32
007.3 DESIGN REVIEW PROCESS	34
007.4 USCG COORDINATION	37
008 WEIGHT AND CENTER OF GRAVITY	37
009 STABILITY AND SUBDIVISION.....	38
009.1 SUBDIVISION	38
009.2 ACCESS AND LOGISTICAL REQUIREMENTS – STABILITY AND SUBDIVISION TESTS.....	38
011 ACCESS & MAINTENANCE REQUIREMENTS.....	38
011.1 GENERAL.....	38
011.2 PIPES, VALVES, ETC	39
011.3 REMOVAL OF EQUIPMENT/MACHINERY	39
011.4 DRAINAGE	39
011.5 HEADROOM	39
011.6 MAINTAINABILITY DEMONSTRATION	39
012 ACCESS TO YARD/VESSEL/DOCUMENTS.....	40
012.1 ACCESS To YARD/VESSEL	40
012.2 ACCESS To DOCUMENTS	40
013 OFFICE.....	40
013.1 OFFICE.....	41
013.2 CONFERENCE AREA.....	41

013.3 PARKING.....	41
015 PROGRESS REVIEW MEETINGS	41
016 WARRANTIES.....	42
017 MATERIALS & WORKMANSHIP	42
017.1 MATERIAL - GENERAL.....	42
017.2 WORKMANSHIP - GENERAL	42
017.3 STORAGE/PROTECTION.....	43
017.4 WELDING.....	44
018 QUALITY ASSURANCE.....	44
018.1 CONTRACTOR QUALITY MANAGEMENT SYSTEM	44
018.2 QUALITY DOCUMENT SUBMITTALS	45
018.3 CONTRACTOR QUALITY ASSURANCE DOCUMENTATION	46
018.4 CONTRACTOR QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES	47
018.5 PROJECT INSPECTION PLAN	49
018.6 AUTHORITY'S PARTICIPATION.....	49
019 HULL & STRUCTURE PROTECTION.....	49
019.1 WELDING.....	49
020 TRAINING	49
020.1 OPERATOR TRAINING	49
020.2 MAINTENANCE TRAINING.....	50
021 SPECIAL EQUIPMENT	51
021.1 PORTABLE TEST UNITS (PTUs)	51
021.2 SPECIAL TOOLS AND FIXTURES.....	52
022 SPARES.....	52
023 FREEZE PROTECTION	52
024 CORE / SCRAP CREDIT	52
025 HIDDEN DAMAGE	52
100. STRUCTURAL	54
101 STRUCTURAL REMOVALS & RELOCATIONS	54
102 ASBESTOS AND LEAD PAINT	54
110 HULLS.....	55
110.1 HULL REPAIRS.....	55
110.2 SHEER GUARDS	56
123 TANKS.....	56
123.1 POTABLE WATER TANK	56
123.2 COLLECTION AND HOLDING TANKS (CHT)	57
123.3 FUEL OIL TANKS	57
130 DECKING.....	57
130.1 DECKING REPAIR PRICING	58
130.2 MACHINERY SPACE & HULL VOID OVERHEAD REPAIR.....	58
131 BRIDGE PLATES (TRANSITION PLATES) AND HOLDERS.....	59
150 SUPERSTRUCTURE	59
150.1 SUPERSTRUCTURE TO HULL ATTACHMENT	60
150.2 CORRUGATED SPLASH GUARD	60
151 EQUIPMENT FOUNDATIONS	60
151.1 MAIN ENGINE FOUNDATIONS & VIBRATION MOUNTS	60
151.2 SSDG FOUNDATIONS	60
151.3 COATINGS:	61
155 WATER JET INTAKE TUNNELS.....	61
166 ENGINE REMOVAL PATCH.....	61
167 WATERTIGHT HATCHES & SCUTTLES	61
167.1 NEW ENGINE ROOM EMERGENCY ESCAPE HATCH.....	61
168 WEATHERTIGHT DOORS.....	62
169 AFT ESCAPE DOOR/HATCH	62
171 MASTS.....	62

200. MECHANICAL	63
233 PROPULSION – DIESEL ENGINES.....	63
233.1 ENGINE MONITORING SYSTEM	63
241 REDUCTION GEARS.....	64
242 COUPLINGS, SHAFTING, SEALS.....	64
246 WATER JETS.....	64
252 ENGINE/PROPULSION CONTROL SYSTEM.....	65
259 EXHAUST SYSTEMS	65
261 FUEL OIL SYSTEM.....	65
262 DIRTY OIL SYSTEM.....	66
300. ELECTRICAL.....	68
301 GENERAL	68
301.1 RIPOUTS	68
301.2 MATERIALS	68
301.3 ARRANGEMENTS	68
301.4 NAMEPLATES AND MARKINGS	68
301.5 NEW OR RELOCATED TERMINATIONS	69
302 ELECTRICAL ANALYSIS	69
311 SHIP'S SERVICE DIESEL GENERATORS	70
313 BATTERIES & CHARGERS	71
313.1 EMERGENCY SERVICE 24V DC.....	71
313.2 ANTICIPATED 24V DC EMERGENCY LOADS.....	72
313.3 BATTERY CHARGERS.....	72
313.4 MAIN ENGINE STARTING BATTERIES.....	72
313.5 GENERATOR STARTING BATTERIES	72
321 POWER DISTRIBUTION.....	73
321.1 SHORE POWER	73
321.2 SSDG INTEGRATION	73
321.3 POWER SOURCE TRANSFER AND LOAD SHEDDING	73
321.4 GROUNDING SYSTEM.....	74
321.5 NEW AND MODIFIED CABLE AND WIREWAYS	74
321.6 RETAINED CABLE	76
321.7 SHORE POWER RECEPTACLE & CABLES	76
321.8 120V POWER RECEPTACLES.....	77
321.9 SWITCHES.....	77
324 SWITCHBOARD & POWER PANELS	78
324.1 MAIN SWITCHBOARD	78
324.2 POWER PANELS & CIRCUIT BREAKERS.....	79
324.3 CIRCUIT BREAKERS	80
324.4 COMMISSARY	80
331 LIGHTING FIXTURES & ILLUMINATION	80
331.1 REFLECTED CEILING PLAN/LIGHTING PLAN AND LIGHTING LEVELS.....	81
331.2 MAIN CABIN LIGHTING	81
331.3 PASSENGER HEADS.....	81
331.4 COMMISSARY	81
331.5 WORK SPACE LIGHTING	81
331.6 EXTERIOR LIGHTING.....	82
331.7 PILOTHOUSE	82
331.8 NAVIGATION LIGHTS & PANEL.....	82
331.9 FLOODLIGHTS	82
331.10 SEARCHLIGHT.....	82
331.11 EMERGENCY LIGHTING	82
331.12 STEP LIGHTS.....	83
331.13 UTILITY SPACE LIGHT	83
400. NAVIGATION, COMMUNICATION AND SAFETY EQUIPMENT.....	84

421 NAVIGATION SYSTEMS.....	84
421.1 FLAGS & SHAPES.....	84
421.2 EMERGENCY SIGNALS	84
421.3 EPIRB.....	84
421.4 ANCHOR SIGNAL BELL.....	84
421.5 MAGNETIC COMPASS.....	84
421.6 SHIP'S HORN	84
421.7 THERMAL IMAGING CAMERA	85
422 NAVIGATION LIGHTS & PANEL	85
423 NAVIGATION & EXTERIOR COMMUNICATION SYSTEMS (ELECTRONIC)	85
431 VESSEL MONITORING SYSTEM.....	87
431.1 FUEL CONSUMPTION MONITORING & REPORTING.....	87
431.2 ON TIME PERFORMANCE (OTP) REPORTING	87
432 TELEPHONE/INTERCOM SYSTEM	88
433 PUBLIC ADDRESS SYSTEMS.....	88
433.1 LOUD HAILER AND CREW COMMUNICATIONS	89
434 WI-FI.....	89
435 PASSENGER INFORMATION SYSTEM.....	89
436 SAFETY DEVICES.....	92
436.1 LIFE RINGS	93
436.2 JASON'S CRADLE RESCUE DEVICE	93
436.3 LIFE PRESERVERS (PFDs)	93
436.4 AUTOMATED EXTERNAL DEFIBRILLATOR (AED).....	93
436.5 FIRST AID KIT	93
436.6 WORK SAFETY VEST	93
436.7 EVACUATION CHAIR.....	94
436.8 INFLATABLE BUOYANT APPARATUS (IBA)	94
436.9 MISCELLANEOUS SAFETY & EMERGENCY EQUIPMENT	94
438 SECURITY CLOSED CIRCUIT TV (CCTV).....	94
438.1 GENERAL DESCRIPTION	95
438.2 SUBMITTALS.....	97
438.3 REGULATORY REQUIREMENTS	101
438.4 GENERAL EXECUTION REQUIREMENTS	101
438.5 INSTALLATION REQUIREMENTS	102
438.6 TESTING REQUIREMENTS.....	102
438.7 SOFTWARE UPDATE REQUIREMENTS.....	103
439 OPERATOR NVR	104
439.1 OPERATOR NETWORK VIDEO RECORDER (NVR)	104
439.2 PILOTHOUSE DISPLAY	105
440 CCTV CAMERAS.....	105
441 RADIO	107
446 AUTOMATIC IDENTIFICATION SYSTEM (AIS).....	108
500. PIPING, INSULATION, HVAC, FIRE SAFETY, ANCHORING & MOORING.....	109
501 PIPING SYSTEMS.....	109
508 INSULATION.....	109
508.1 THERMAL	109
508.2 PIPING INSULATION	109
511 HEATING, VENTILATION AND AIR CONDITIONING (HVAC).....	110
511.1 GENERAL.....	110
511.2 HVAC CALCULATIONS	110
511.3 ALTERNATE PERFORMANCE STANDARDS	111
511.4 MAIN CABIN	111
511.5 HEADS.....	117
511.6 PILOT HOUSE.....	118
511.7 MACHINERY SPACE VENTILATION	118

511.8 UPPER DECK PASSENGER AREA	118
511.9 OTHER SPACES	118
511.10 PROTECTIVE HEATERS.....	118
520 SEA CHESTS & VALVES	119
521 FIRE MAIN & BILGE PUMP SYSTEM.....	119
521.1 BILGE SYSTEM	119
521.2 FIRE MAIN SYSTEM	119
526 SCUPPERS AND DECK DRAINS	120
526.1 GENERAL.....	120
526.2 LOADING AREA DRAIN PANS	120
526.3 DECK DRAINS.....	120
528 SANITARY SYSTEM.....	120
533 POTABLE WATER SYSTEM.....	121
555 FIRE EXTINGUISHING.....	121
555.1 GENERAL SCOPE.....	121
555.2 FIXED SYSTEM.....	121
555.3 PORTABLE EQUIPMENT.....	122
568 STEERING CONTROL SYSTEM.....	122
581 ANCHOR HANDLING AND STOWAGE.....	123
582 MOORING SYSTEM.....	123
600. OUTFITTING & MARKINGS.....	124
602 SIGNAGE & MARKINGS.....	124
602.1 GENERAL.....	124
602.2 REGULATORY HULL MARKINGS.....	124
602.3 LOGOS	124
602.4 BUILDER'S PLAQUE	124
602.5 AUTHORITY'S STANDARD SIGNAGE	125
602.6 LOW LEVEL EXIT PATH MARKING (LLEPM).....	125
602.7 LABELS.....	126
602.8 FIRE SAFETY & EVACUATION PLAN	126
611 HULL FITTINGS	127
611.1 DOORS, EXTERIOR WEATHER-TIGHT	127
611.2 DOORS, INTERIOR JOINER	128
611.3 BITTS, CHOCKS, & FAIRLEADS	128
612 RAILS & STANCHIONS.....	129
621 NON-STRUCTURAL BULKHEADS.....	129
622 DECK PLATES, GUARDS, & LIFTING GEAR.....	129
622.1 DECK PLATES	129
622.2 GUARDS.....	129
623 LADDERS, STAIRS, & GATES.....	129
623.1 VERTICAL LADDERS.....	129
623.2 STAIRS.....	129
623.3 GATES	130
625 WINDOWS	130
625.1 WINDOW REMOVALS.....	130
625.2 PILOTHOUSE WINDOWS	131
625.3 MAIN DECK WINDOWS.....	131
631 PAINTING.....	132
631.1 COATING REMOVAL	132
631.2 GENERAL.....	132
631.3 EXTERIOR	133
631.4 INTERIOR	134
631.5 PAINTING AND STYLING SCHEMES	134
633 CATHODIC PROTECTION.....	134
634 INTERIOR DECK COVERINGS.....	135

634.1 MAIN DECK PASSENGER CABIN	135
634.2 PASSENGER HEADS.....	135
634.3 COMMISSARY	135
634.4 ENTRANCE MATTING.....	135
634.5 PILOTHOUSE INTERIOR	136
634.6 SAFETY MATTING.....	136
644 PASSENGER HEADS	136
645 PASSENGER SPACES	137
645.1 GENERAL.....	137
645.2 MAIN DECK PASSENGER SPACE	138
645.3 UPPER DECK.....	139
646 PILOTHOUSE SPACE	140
646.1 PILOTHOUSE CONSOLE MOCK UP.....	141
650 MACHINERY SPACES.....	142
651 COMMISSARY SPACE.....	143
654 UTILITY SPACES.....	144
671 LUGGAGE STOWAGE.....	144
672 TICKET COUNTER	144
673 BICYCLE RACKS.....	145
900. TESTS, INSPECTIONS, TRIALS & SERVICES.....	146
901 PRE-BID INSPECTION	146
902 VESSEL TRANSPORT TO CONTRACTOR AND INITIAL INSPECTIONS.....	147
902.1 PRE-SHIPMENT INSPECTION	147
902.2 TRANSPORT TO CONTRACTOR	147
902.3 REMOVAL OF CONSUMABLE STORES, SEWAGE & BILGE SLOPS	147
902.4 GAS FREEING.....	148
902.5 RECEIVING INSPECTION	148
903 PRE-OVERHAUL TESTS AND INSPECTIONS.....	148
903.1 SPEED TRIAL	148
903.2 HULL SURVEY	149
903.3 SOUND AND VIBRATION MEASUREMENTS.....	149
903.4 HAZMAT SURVEY	149
904 IN-PROCESS INSPECTIONS	149
904.1 GENERAL.....	149
904.2 SCHEDULING & ATTENDANCE.....	150
904.3 PREPARATIONS	150
904.4 REQUIRED INSPECTION POINTS.....	150
904.5 RE-INSPECTIONS.....	152
904.6 UNDERWATER HULL INSPECTION (AS APPLICABLE).....	152
905 FIRST ARTICLE INSPECTIONS.....	153
906 CREDIT DRYDOCKING.....	153
981 SURVEY & MEASUREMENT.....	154
981.1 DEAD WEIGHT SURVEY & FREEBOARD.....	154
981.2 ADMEASUREMENT TONNAGE	154
982 TRIALS – GENERAL	155
982.1 GENERAL.....	155
982.2 TEST & INSPECTION PLAN	155
982.3 TEST & INSPECTION PROCEDURES.....	155
982.4 TEST AND INSPECTION REPORTS.....	156
983 FUNCTIONAL TESTS (SUPPORTED AND APPROVED BY VENDOR REPRESENTATIVES)	156
984 DOCK TRIALS	156
984.1 GENERAL.....	157
984.2 REQUIRED DOCK TRIALS	157
985 SEA TRIALS	158
985.1 GENERAL.....	158

985.2 SCHEDULING & ATTENDANCE.....	159
985.3 ATTENDEES	159
985.4 SEA TRIAL LOCATION.....	159
985.5 SEA TRIAL DEADWEIGHT	160
985.6 SEA TRIAL VESSEL & AMBIENT CONDITIONS.....	160
985.7. REQUIRED SEA TRIALS	160
986 POST-DELIVERY TRIALS IN OWNER'S VENUE.....	161
986.1 GENERAL.....	161
986.2 BOARDING & DEBARKING/DOCK INTERFACE.....	162
986.3 NEW TO ZONE USCG SECTOR INSPECTION	162
987 SHIPMENT AND DELIVERY	162
988 CERTIFICATIONS, REGISTRATIONS, AND OTHER REQUIRED DOCUMENTATION OR APPROVALS	163
994 CLEANING.....	163
997 DRYDOCKING	164

APPENDIX A: MBTA STANDARD DRAWING FORMAT

APPENDIX B: HULL SURVEY

APPENDIX C: CCTV EQUIPMENT SPECIFICATIONS

APPENDIX D: DEADWEIGHT SURVEY – MV LIGHTNING

APPENDIX E: CONTRACT DELIVERABLE REQUIREMENTS LIST (CDRL)

APPENDIX F: MAIN ENGINE OVERHAUL SPECIFICATION

APPENDIX G: WATERJET OVERHAUL SPECIFICATION

APPENDIX H: BRIDGE PLATE SAMPLE DESIGN

- SECTION NUMBERING CONFORMS TO THE STANDARD SHIP WORK BREAKDOWN STRUCTURE “SWBS” SYSTEM -

000. GENERAL PROVISIONS

001 INTRODUCTION AND GENERAL SCOPE

These Specifications are performance based and provide requirements for the overhaul of two 149-passenger, high speed ferries – Flying Cloud and Lightning – owned by the Massachusetts Bay Transportation Authority (MBTA or “the Authority”). These vessels are used in commuter service between the Boston and the South Shore of the Boston region.

The vessels are designed and constructed to be fully capable in all respects of providing reliable, year-round service in the Boston region with a certification for Lakes, Bays and Sounds, Cold Water Service – these capabilities and certification shall be maintained through the overhaul. The vessels after overhaul shall continue to conform to all regulations that apply to a 46 CFR Subchapter “T” Passenger Vessel with a Gross Regulatory Tonnage not to exceed 100GT (Gross Tons). The vessels are not and shall not be classed; however, all work performed during overhaul shall be per ABS or DNV High Speed and Light Craft Rules and shall, in all respects, be performed according to good shipbuilding practices.

The vessel’s overhaul shall comply with Federal Transit Administration (FTA) funding requirements. It is expected that the overhaul shall bring the vessels into a like-new, state of good repair and extend the service life of the vessels by a minimum of 10 years. The Contractor is to comply with the provisions of the FTA Buy America requirements, where applicable, and as detailed in the Terms and Conditions.

The Contractor shall be responsible for transport of the vessels to the Contractor’s facility, and delivery of the overhauled vessels to an Authority-designated facility in the greater Boston, MA area. Upon delivery, all vessel systems shall be in operation, and ready for service. Each vessel as released to the Contractor will have a valid C.O.I. At the conclusion of each vessel’s overhaul, the Contractor shall assist the Authority in obtaining a valid re-issue of the C.O.I.

001.1 TASK LIST - FOR GENERAL GUIDANCE ONLY

This Section is not intended to include all tasks that may be required by the Contract Bid Package. It is included as a guidance check list that will assist the Contractor in identifying and tracking primary work items. This list does not reflect all specific requirements of the Contractor and should not be used as the sole basis for estimating this Contract. Should there be a disagreement between this list and the more detailed sections of the specification, the more detailed sections shall prevail.

1. **Removals General** – Accomplish removals as detailed in these Specifications. Scrap removed materials unless otherwise directed in the Specifications or by the Authority. Scrapping shall be in accordance with all Federal, State, and Local regulations applicable.
2. **Joiner Removals** – Main Deck and Pilothouse. Remove all joiner work including drop ceilings, bulkhead panels, furnishings, commissary structure and equipment, sanitary fixtures, lighting fixtures, communication system fixtures, alarms, etc.

3. **Deck Coverings** – Remove all main deck, upper deck and pilothouse deck coverings. Replace deck coverings in accordance with Section 634.
4. **Coatings** – The exterior fiberglass hulls, keel to waterline shall be media blasted down to gelcoat and recoated with a full primer and anti-fouling system in accordance with Section 631. The superstructures shall be blasted, prepped, and shall receive a full coating system in accordance with Section 631.
5. **Structural Repair** – All hull conditions identified in the FLYING CLOUD hull survey of April 2020 (see Appendix B) and a Contractor-furnished LIGHTNING hull survey shall be repaired in accordance with Section 110 prior to recoating. Any identified damage or deterioration of the superstructure shall be repaired in accordance with Section 150 prior to recoating. Decking shall be repaired in accordance with Section 130.
6. **Hatches** – Replace or recondition hatches (see Section 167), replace hardware for engine removal patch. Install new emergency escape aft of the main engine in each engine room (See Section 167.1). Engine removal patch shall be reconditioned per Section 166.
7. **Main Engines** – Overhaul at MTU certified shop per OEM requirements, Section 233 and Appendix F.
8. **Gears & Shafting** – Rebuild gears at ZF certified shop in accordance with Manufacturer's recommendations and Section 241. Replace cardan shafts (see Section 242).
9. **Waterjets & Steering Control System** – Rebuild at MJP certified shop per OEM recommendations, Section 246, and Appendix G. Replace steering control system with new (see Section 568).
10. **Exhaust** – Replace with new, including modifications for new and additional SSDGs per Section 259.
11. **Fuel Oil System** – Replace fuel oil tanks with new. Replace suction and return lines valves, hoses, pumps and filters with new, including modifications for additional SSDG. Replace vent piping, foredeck high-level alarm, and pilothouse display and alarms. (see Section 261)
12. **Electrical** – Develop AC and DC electrical load analyses and one-line diagrams. Replace power panels, main switchboard and grounding system in accordance with Sections 321 and 324. Additional or modified wiring shall be provided and installed as required to support other modifications in this specification. Replace batteries and battery chargers per Section 313. Add receptacles in passenger spaces, commissary, and pilothouse. Remove obsolete wiring.
13. **SSDG Existing** – Remove existing SSDG located in starboard Engine Room. Provide and install replacement SSDG to meet Contractor's electrical load analysis. If

suitable, the Authority prefers the John Deere 4045TFM85, Tier 3, SSDG installed in its other vessels. (see Section 311)

14. **SSDG Additional** – Provide and install a second SSDG in the port side engine room in way of existing Potable Water Tank. Relocate Potable Water Tank. The new genset shall have new cabling to the new switchboard. SSDG shall be identical to the new starboard SSDG. (see Section 311)
15. **Alarms & Monitoring** – Modify, as required by equipment renewal, replacement, additions
16. **Lighting Interior** – Replace existing interior lighting with LED downlights in interior passenger spaces. Replace florescent and incandescent with LED in machinery spaces, voids, lockers, pilothouse. (see Section 331)
17. **Lighting Exterior** – Replace flood lights with LED. Replace search light. Add new step lights. Replace exterior deck lighting with new LED. (see Section 331)
18. **Navigation Equipment** – Provide and install new navigation electronics per Section 423. Provide and install new EPIRB, overhauled air horn. Replace navigation lights and panel with new per Section 422.
19. **Vessel Monitoring System** – Provide and install a vessel monitoring system per Section 431 to provide vessel location and fuel consumption tracking.
20. **CCTV & Operator Camera Systems** – Replace CCTV system with new, and install additional Operator Network Video Recording System (see Sections 438, 439, 440 and Appendix C).
21. **PA, Intercom, Passenger Information System, and Passenger Wi-Fi** – Provide and install a new passenger information system per Section 435, which shall be integrated with the PA system to be replaced by the Contractor (see Section 433). Install new crew intercom system and loud hailer (see Section 432) as well as a telephone/intercom system for communication between the pilothouse, commissary and bow doors (see Section 431). Provide a passenger Wi-Fi system per Section 434.
22. **Safety Devices** – Provide new life rings, additional life preservers, IBAs, and evacuation chair per Section 436.
23. **Insulation** – Replace all with new.
24. **HVAC** – Remove current system, provide new system that incorporates fresh air, bulkhead or floor heating, centralized thermostat control, and appropriate heating and cooling capacity per the Contractor's HVAC calculations. See Section 511.
25. **Bilge and Fire Main Systems** – replace pumps, valves, hoses, strainers and gauges with new. Add new bilge system deck fitting to allow bilge water to be pumped dock side (see Section 521).

26. **Fire Extinguishing** – Recertify engine room fire suppression system and portable fire extinguishers per Section 555.
27. **Potable Water and Sanitary System** – Replace piping and modify saltwater flushing system to fresh water. Replace 100-gallon fresh water tank with new 200-gallon tank and relocate to make space for new port side SSDG. Replace sewage tank (CHT) with new. (see Sections 528 and 533)
28. **Joiner Doors** – Remove existing and provide and install new doors in-kind for passenger heads and lockers per Section 611.
29. **Weathertight Doors** – Remove existing watertight & weathertight doors and replace with new in-kind aluminum doors per Section 611.

Doors to be replaced: Main Deck forward (2) watertight hinged, Main Deck side P&S weathertight sliding (2), Main Deck aft (1) weathertight hinged, Pilothouse P&S (2) weathertight hinged.
30. **Deck Plates** – Replace the deck plate on the exterior aft catwalk with new. (see Section 622)
31. **Windows** – Remove all existing main deck and pilothouse windows and replace with new per Section 625.
32. **Signage** – Remove existing signage, provide and install all signage and markings required by the USCG, MBTA and MassDOT logos, builder's plaque, Authority-required signage, Low Level Exit Path Marking, and labels for piping, valves, gauges, controls, and equipment (see Section 602).
33. **Rails and Gates** – Clean and repair rails and bow loading gates. Replace hinged side loading gates with sliding gates. Add new hinged upper deck gates to keep passengers from the areas next to the port and starboard pilothouse doors (See Section 623).
34. **Passenger Heads** – Modify one passenger head per vessel to be compliant with ADA/PVAG. In all heads, replace plumbing, fixtures, lighting, ceiling panels and bulkhead linings. (see Section 644)
35. **Passenger Spaces** – Refurbish main deck passenger compartment, including seats, tables, carpeting, bulkhead linings, ceiling panels, lighting, add electrical outlets. Modify as required to comply with ADA/PVAG requirements, including the addition of mobility device locations and tie downs and clear paths (see Sections 634 and 645). Refurbish upper deck covered passenger area, recoat all surfaces. (see Section 645) Provide upgraded ticket counter. (see Section 672)
36. **Commissary** – Remove the existing Commissary and reinstall newly designed commissary incorporating ADA/PVAG compliance, upgraded equipment, new floor covering, lighting and storage. (see Section 651)

37. **Pilothouse** – Remove existing interior joinery (bulkheads, ceiling panels), consoles, fittings, electronic equipment, navigation equipment, electrical panels. All removals shall be either scrapped or returned to the Authority, per the Authority's direction. Design, provide, and install new console and equipment arrangement per Section 646. Provide and install new helm chair.
38. **Bike Racks** – Provide bike racks on the vessel bow. (see Section 673)
39. **Credit Drydocking** – The Contractor shall perform all requirements of the USCG-required bi-annual drydocking to the satisfaction of the attending USCG Inspector.
40. **Tests, Inspections, Dock & Sea Trials** – Perform all tests, inspections and trials required by Section 900.
41. **Documentation** – Provide all drawings, design packages, vessel history books, manuals and maintenance instructions, and other documentation required by Section 006.

002 GLOSSARY

002.1 ABBREVIATIONS

As used throughout these Specifications, the following partial list of terms and abbreviations shall have the meanings stated:

ABS	American Bureau of Shipping (classification society)
ADA	Americans with Disabilities Act
AIS	Automatic Identification System
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
The Authority	The Massachusetts Bay Transportation Authority, or MBTA
AWS	American Welding Society
BOM	Bill of Material
CCTV	Closed Circuit TV
CDRL	Contract Deliverable Requirements List
CFR	Code of Federal Regulations

CHT	Sewage Tank “Collection & Holding Tank”
CMR	Code of Massachusetts Regulations
COI	Certificate of Inspection
COLREGS	Navigation Rules of the Road
Contractor	(same as YARD or SHIPYARD)
Contract	Overhaul Contract between Authority and the Contractor. The Contract shall include these Specifications and Addendums
CuNi	Copper Nickel Alloy
CRES	Stainless Steel (SST)
DFT	Dry Film Thickness
DNV	Det Norske Veritas
DGPS	Differential Global Positioning System
DNV	Det Norske Veritas (classification society)
DOJ	U.S. Dept. of Justice
DOT	U.S. Dept. of Transportation
DVTP	Design Verification Test Procedure
DWG	Contract Drawing
ECM	Engine Control Module
EDM	Electronic Display Module
E-LIGHT	Light on Emergency Lighting Circuit
EPA	Environmental Protection Agency
EPIRB	Emergency Position Indicating Radio Beacon
ER	Engine Room
FAI	First Article Inspection
FCC	Federal Communications Commission

FMEA	Failure Mode Effects Analysis
FO	Fuel Oil (in US gallons)
FRP	Fiber Reinforced Plastic
FTA	Federal Transit Administration
FW	Freshwater (in US gallons)
GPM	Gallons per Minute
HP	Horsepower
HVAC	Heating, Ventilation, and Air Conditioning
IBA	Inflatable Buoyant Apparatus
IEEE	Institute of Electrical & Electronics Engineers
IES	Illumination Engineering Society
ITC	International Tonnage Commission
JCM	Jet Control Module
JR	Jet Room
LCG	Longitudinal Center of Gravity
LLEPM	Low Level Exit Path Marking
LRU	Line Replaceable Unit – a modular component that is designed to be replaced in the field by swapping out with another identical unit. This is the lowest level of component that would be removed in regular maintenance, with any repair thereof performed elsewhere.
LT	Long Ton - 2240 pounds
MAAB	Massachusetts Architectural Access Board
MARPOL	International Convention for Prevention of Pollution from Ships
MBTA	Massachusetts Bay Transportation Authority
ME	Main Engine
MIG	Metal Inert Gas (Welding)

MSO	Marine Safety Office, USCG
MSC	Marine Safety Center, USCG (Washington, DC)
NEMA	National Electrical Manufacturer's Association
NIST	National Institute of Standards & Technology
NTP	Notice to Proceed
NUC	Not Under Command
NVIC	Navigation and Vessel Inspection Circular
OCMI	Officer in Charge of Marine Inspection
OCU	Outdoor Condensing Unit
OEM	Original Equipment Manufacturer
OF or OFE	“Owner Furnished” or “Owner Furnished Equipment”
Owner	Massachusetts Bay Transportation Authority
Overhaul	Return of the vessels to a state of good repair per the requirements of the Technical Specification, including transportation to and from Contractor's facility
P	Port
P&S	Port and Starboard
PFD	Personal Flotation Device
PLC	Programmable Logic Controllers
POC	Point of Contact
PSTP	Periodic Safety Test Procedure
PTU	Portable Test Unit
PVAG	Passenger Vessel Accessibility Guidelines 2013
QA	Quality Assurance
QAWT	Quick Acting Watertight
QMS	Quality Management System

RFP	Request for Proposal
S	Starboard
SEAL WELD	Structure which is double continuously welded
SHIPYARD	Contractor or YARD
SNAME	Society of Naval Architects & Marine Engineers
SSDG	Ship Service Diesel Generator
SST	Stainless Steel (CRES)
SW	Saltwater
SWBS	Ship Work Breakdown Structure (numbering system)
TIG	Tungsten Inert Gas (Welding)
TLI	Tank Level Indicator
TWIC	Transportation Workers Identity Card
UL	Underwriters Laboratories
USAB	United States Access Board
USCG	United States Coast Guard
USCG/MSC	United States Coast Guard Marine Safety Center (Washington DC)
USG	U.S. Gallons
USPHS	United States Public Health Service
UV	Ultra-violet
VCG	Vertical center of gravity
VESSELS	Ships under contract, M/V FLYING CLOUD and M/V LIGHTNING
VMS	Variable Message Sign
WTD	Watertight Door(s)
YARD	Contracting Shipyard (same as Contractor)

002.2 EXPANDED DEFINITIONS

002.2.1 CONTRACTOR-FURNISHED EQUIPMENT

Unless otherwise stated, the terms “provide,” “supply,” “install,” and other similar terms, as related to the Contractor, shall be understood to mean that the Contractor is responsible for purchasing, integrating, installing, and warranting the associated piece of equipment or system in working condition. This includes all associated wiring, piping, and other connections, as well as consumables such as fluids, necessary for the proper functioning of the equipment or system.

For example: floodlights or navigation lights that are to be “provided” and “installed” will be purchased by the Contractor, installed with foundations, wired, powered, switched, and tested complete. This includes any necessary integration with other systems and consideration of interference and other effects on the vessel. The lights, and all associated parts required for the proper installation and operation of the lights (excluding consumables) will also be warranted per the requirements of these Specifications. If cable is required to bring power to that light, the cable shall be provided, integrated, installed and warranted as part and parcel of the light installation. If a kick-pipe is required, that kick-pipe shall be part of the installation.

002.2.2 AUTHORITY-FURNISHED EQUIPMENT

All equipment herein specified as owner-furnished (OFE) is to be installed by the Contractor in such condition that it is completely operational and serviceable under normal conditions of vessel operations. Such installations are to adhere to all applicable specifications of regulatory agencies and are to be to the satisfaction of the Authority. This includes, but is not limited to, the following:

- a. Time and materials for assembly
- b. Time and materials for positioning and proper securing
- c. Time and materials for connections of piping, wiring, etc.
- d. Time and materials for operational testing

OFE equipment, when specified, shall be new equipment in current production. It shall be supplied to the Contractor with installation instructions, vendor references, and vendor POC. All equipment, which is NOT herein specified as OFE, shall be Contractor furnished.

Except for purchasing the equipment, all other Contractor responsibilities for Contractor furnished equipment apply for OFE equipment.

002.2.3 GOOD SHIPBUILDING PRACTICE

The term "good shipbuilding practice" means construction practices which are in accordance with soundly engineered and detailed drawings, approved by the Authority and USCG, and are suitable for the marine operating environment. Drawings are to meet the requirements contained within these Specifications. Overhaul and testing shall conform to regulatory agency and industry accepted standards to ensure that all work and materials supplied through the overhaul will meet the general and specific design requirements.

002.2.4 MINIMUM SERVICE LIFE/USEFUL LIFE

The overhauled vessel must be overhauled to extend the service life of the vessels for a minimum of another 10 years after overhaul.

002.2.5 SOLE SOURCE/BID SUBSTITUTIONS/IN-KIND REPLACEMENTS

Trade names, manufacturers' names and part numbers, and in-kind replacements throughout this specification are not "sole source" items, unless expressly stated in these Specifications. Such references are provided for information and guidance as to products which will be suitable, and to assist the Contractor in assessing and meeting the material and operational requirements of the proposed vessel. The items specified are now in use on the Authority's ferry fleet, and/or have met the operating requirements of reliability, maintainability, life expectancy and interchangeability.

The Contractor is responsible for selecting equipment to provide a fully functional, integrated vessel and equipment, meeting all regulatory requirements and the performance criteria in these Specifications. The Contractor is permitted to submit bids containing substitutions ("or equals") if such substitutions are clearly stated and detailed. Any substitution must be at least equal to the specified model, must be sufficiently documented to prove quality, and must meet the performance requirements of each vessel.

The Contractor is responsible for all additional costs associated with proposed substitutions including, but not limited to, required engineering expenses, and modifications to foundations, connection sizes, electrical interfaces, etc. which will render the substitution fully compatible with other installed equipment. In this regard, the Specifications herein are guidelines for minimum performance requirements. If those Specifications are not offered by a particular manufacturer, product, or model, the Contractor will be expected to include a separate list of all discrepancies. Substituted manufacturers, products, or models will not be considered unless they have been demonstrated to be equal to or exceeding the quality, durability and design and the minimum performance functions of the specified equipment. Any proposed substitution must conform substantially to the specified requirements for the machinery and/or equipment, including manufacturer's product support for (10) ten years.

Where the Contractor desires to provide substitute equipment or components for those specified in these Specifications, the drawings, or the Contractor's Proposal, the Contractor shall present, for the Authority's review and approval, written documentation that the equipment and/or components proposed qualify as equal to those specified, and that spare parts and service for them are readily available.

Proposed substitutions shall not adversely affect any other component or system in the vessel; adversely affect the vessel's total performance; or relieve the Contractor from any obligation related to performance, warranty, etc. Any proposed substitution shall function as effectively as the equipment specified, with no increase in required maintenance or need for premature replacement.

002.2.6 IN-PROGRESS SUBSTITUTIONS

It is the intent of these Specifications that all equipment shall be provided as specified herein. Substitutions shall be considered on a "case by case" basis upon timely written notice from the Contractor to the Authority; or, in the case of the Authority's generated substitution, upon timely written notice from the Authority to the Contractor. Such written notice shall include written documentation that the equipment and/or components proposed qualify as equal to those specified and that spare parts and service for them are readily available. The Authority or Contractor is under no obligation to accept substitutions by either party of any materials or equipment unless this written process is adhered to and both have signed off in agreement. The Authority has the final decision concerning the acceptance of substitutions.

002.2.7 SUBSTITUTION CHECK LIST

The following items should be considered, and documented as part of the written substitution request, when bidding substitutions or proposing in-progress substitutions. Particular attention shall be paid to quality, reliability, performance, maintenance requirements, technical support and safety.

1. Functionality:

- Functional characteristics
- Electrical characteristics
- Capacities (GPM, pressure, volume, wattage, HP, etc.)

2. Performance:

- Industry performance
- Rate service duty life
- Reliability in similar applications

3. Quality:

- Quality of fabrication, welding, and construction details
- Materials of Construction (high quality marine grade)

4. Maintenance

- Maintenance life cycle
- Ease of maintenance
- Manufacturer's ability to support

5. Standards & Regulations:

- Regulatory Body approval
- Constructed to recognized standards (UL, IEEE, ANSI, ASTM, etc.)
- Effect on vessel's compliance with FTA Buy America

6. Safety Features

7. Form:

- Conformance to salient features
- Dimensional characteristics
- Weight

002.2.8 AUTHORITY-APPROVED

The direction, permission or requirement of the Authority is intended; the words approved, acceptable, satisfactory, or words of like import shall mean approved by, acceptable to, or satisfactory to the Authority; and the words necessary, suitable, equal, or words of like import shall mean necessary, suitable or equal in the opinion of the Authority.

002.3 REMOVALS

Removals of equipment shall include the removal of associated brackets, hangers, wiring, etc. Power cables shall be pulled back to the first junction box. Piping shall be removed back to source and capped. Exposed areas that have had equipment removed shall have welds ground smooth and coated with the paint system.

All excess and removed materials shall be made available to the Authority for inspection. Disposition of these materials shall be approved by the Authority and, shall, in any case be in

accordance with Federal, State, and Local ordinances and regulations. This applies in particular to any hazardous materials to be disposed of.

002.4 INSTALLATIONS

Modifications and upgrades shall be shown on the Contractor's Contract drawings. The final systems shall be tested for operational performance by the Contractor's and/or Contractor's Tech Rep and approved by the Authority. The Contractor shall provide a written report of performance to the Authority.

003 REGULATIONS, DOCUMENTATION, CERTIFICATION

003.1 COMPLIANCE

The overhauled vessel, as delivered, shall comply with the requirements of applicable Local, State and Federal Regulatory Agencies. These shall include, but shall not be limited to:

- USCG: 46 CFR Subchapter "T" & "S" Passenger Vessel (Lakes, Bays and Sounds)
- Buy America clauses, as detailed in the Terms and Conditions
- USPHS: Publication No.393, "Handbook on Sanitation of Vessel Construction"
- USCG: Inland Rules of the Road (COLREGS)
- Institute of Electrical & Electronics Engineers Standards #45 (IEEE)
- Federal Communications Commission (FCC)
- United States Access Board (USAB) (PVAG) Revised Draft Passenger Vessel Accessibility Guidelines, as published in the Federal Register on June 25, 2013, USDOT 49 CFR Parts 39, Transportation for Individuals with Disabilities: Passenger Vessels. All interior passenger elements not specifically addressed by PVAG, shall conform with US DOT 49 CFR Part 37 (and Subpart C) as well as 49 CFR Part 39.

If a conflict exists between State and Federal accessibility requirement/code the more stringent code must be followed. In addition, all design elements shall comply with the minimum Federal requirements/code even if a State requirement/code is less stringent. The Contractor is responsible for ensuring compliance with all applicable regulations. Any error or omission in these Specifications shall not relieve the Contractor from this obligation, and the obligation to immediately bring all discrepancies to the attention of the Authority.

003.1.1 ERRORS AND OMISSIONS

In the event that errors or omissions are found in these SPECIFICATIONS that would have an adverse effect upon the completion of this Contract and/or delivery to the Authority of a vessel that is complete, functional, and seaworthy, the Contractor shall call attention to such errors or omissions in his bid package.

Minor design errors or omissions shall be addressed by the Contractor in the normal course of the Contract performance and in compliance with the Contract requirements to use “Good Shipbuilding Practices” and to, at the conclusion of the Contract, to deliver to the Authority a seaworthy, fully operational vessel which can immediately enter its intended commercial service.

Major design errors, omissions, or modifications shall be resolved by Change Order per the Commercial Terms and Conditions.

003.1.2 SPECIFICATIONS IN EXCESS

The Specifications require that modifications be performed in accordance with the requirements of the regulatory bodies referenced herein. However, if the specification requires any modifications in excess of those required by the referenced regulatory bodies, the more stringent requirements of the specification must be followed, unless written approval is received from the Authority.

003.2 DOCUMENTATION

All necessary certifications and/or documents covering the approval of, and indicating compliance with, applicable regulations shall be obtained by the Contractor and supplied to the Authority. The Authority shall provide the Contractor, in writing, any Authority-specific information required to complete required documentation. It is the Authority's responsibility to provide the Contractor with a receipt for documents received and to retain these documents for presentation to regulatory inspectors as and when required.

003.3 CERTIFICATION

The overhauled vessels will remain compliant with the regulations of 46 CFR Subchapter “T” Small Passenger Vessels (under 100 GT). It shall be certified for “Lakes, Bays and Sounds” and “Cold Water” service. The Authority is responsible for notifying the Contractor of any special USCG requirements or mandates which shall be imposed by the USCG Local OCMI in the Authority’s operating venue. A notification of any such requirement shall be made prior to Contract Award.

The Contractor is responsible for providing a vessel that will meet all requirements to receive the necessary certifications, including those obtained by the Contractor and by the Authority. This includes, but is not limited to:

- Stability Letter
- Certificate of Inspection
- EPIRB Registration
- Fire Safety Instructions
- Compass Deviation Card

- MARPOL placard
- Emergency Evacuation Plan

The latest amendments to all laws, regulations, rules and conventions, which are in force at the time of Contract Award, are to be considered as part of the Contract. Any amendment to such requirements or any new laws, regulations, rules or conventions that come into force after Contract Award, shall be treated as a change to the Contract, if not otherwise covered by these Specifications.

003.3.1 CERTIFICATION DISPLAY CASES

The Contractor shall provide and install on each vessel: two (2) Authority-approved, aluminum, Plexi-glass front cases with hinged door(s) and lock provided. One shall be installed in the pilothouse, and one in the passenger space, in Authority-approved locations for display of the following documents:

Pilothouse:

- Stability Letter
- FCC Documents
- Compass Deviation Card
- MARPOL placard

Passenger Space:

- Certificate of Inspection
- Fire Safety Instructions
- Emergency Evacuation Plan
- Operator's Licenses

003.3.2 CONTRACTOR-SUPPLIED CERTIFICATIONS

At delivery of each overhauled vessel, the Contractor shall provide the Authority with the following documentation, posted in the certification display cases:

- Stability Letter **[CDRL 3-1]**
- FCC Documents **[CDRL 3-2]**
- Fire Safety Instructions **[CDRL 3-3]**

- Compass Deviation Card **[CDRL 3-4]**
- MARPOL placard **[CDRL 3-5]**
- Emergency Evacuation Plan **[CDRL 3-6]**

004 GENERAL SPECIFICATION REQUIREMENTS

004.1 GENERAL

These Technical Specifications (“Specifications”) provide details of a Request for Proposal (RFP) for the overhaul of a high-speed catamaran ferry. The overhauled vessels shall conform to all regulations that apply to a 46 CFR Subchapter “T” Passenger Vessel with a Gross Regulatory Tonnage not to exceed 100 GT. The vessels after overhaul shall continue to be certified for “Lakes, Bays and Sounds” and “Cold Water” service. The overhauled vessels shall comply with the requirements of Buy America, as detailed in the Terms and Conditions.

These Specifications are intended to give the Contractor all necessary information for the completion and submittal to the Authority of an overhaul proposal. The submitted Proposal shall provide for transportation to the Contractor’s facility and return delivery to the Authority as completely outfitted, integrated, seaworthy, and operational overhauled vessels that meet all applicable requirements of the applicable CFRs, pertinent regulatory bodies, and these Specifications.

004.2 GENERAL VESSEL DESCRIPTION

The vessels to be overhauled are waterjet driven, diesel propelled, catamaran, Subchapter “T” passenger vessels with an arrangement of accommodations, stores, tanks, machinery, etc. suitable for a commuter service in the Boston region. An overview of the vessels is as follows:

Builder	Gladding-Hearn Shipbuilding
Year Built	1996
Official Numbers	LIGHTNING 1048476 FLYING CLOUD 1047743
Primary Route	Greater Boston Harbor
Classification	46 CFR Subchapter “T” Lakes, Bays, & Sounds, Partially Protected Waters, Cold Water Service
Length Overall (approximate)	26.9 meters (88.4 feet), including jet guards
Length Waterline	23.5 meters (77.1 feet)

Beam Overall (approximate)	8.4 meters (27.6 feet)
Beam of each Hull	2.3 meters (7.6 feet)
Draft	0.9 meters (3 feet)
Freeboard:	6'8"
Gross Registered Tonnage:	70 GT
Net Registered Tonnage:	47 GT
Lightship Displacement:	47.869 LT
Top Speed:	Estimated at 30 knots while carrying the Sea Trial Deadweight detailed in Section 982. Actual top speed shall be confirmed by Contractor in pre-overhaul speed trial per Section 903.1.
Service Speed:	Estimated at 28 knots at 85% power while carrying the Sea Trial Deadweight detailed in Section 982. Actual service speed shall be confirmed by Contractor in pre-overhaul speed trial per Section 903.1.
Potable Water Capacity:	100 USG
Sewage Capacity:	200 USG (2 x 100 USG tanks)
Passenger Capacity:	149
Engines:	MTU 2000M70, 12-cylinder 1055 HP @ 2100 RPM
Fuel Oil Capacity	1400 USG (2 x 700 USG tanks)
Waterjets & Impellers:	MJP550
Reverse/Reduction Gears:	ZF 2050
Generator:	Northern Lights M944T-38KW

004.4 ADA/PVAG REQUIREMENTS

The vessels were designed with level boarding through a bow loading design. This capability shall be maintained after overhaul. The overhaul shall incorporate any additional modifications for compliance with all applicable accessibility laws, regulations, and

recommendations applicable at the time of submission of proposal by the Contractor, including recommendations documented in the United States Access Board (USAB) Draft Passenger Accessibility Guidelines (PVAG) as published in the Federal Register on June 25, 2013, United States Department of Justice (DOJ), United States Department of Transportation (DOT), Federal Transit Administration (FTA), and Massachusetts Architectural Access Board (MAAB) and the MBTA/BCIL settlement agreement.

This includes, but is not limited to:

- Passenger Information System
- Mobility device locations & tie downs
- Commissary modifications
- Head modifications
- Door upgrades – thresholds, pull force
- Passenger cabin layout – accessible paths, turning radius, etc.
- Passenger Head
- Signage

PVAG Guideline references are provided in the following paragraphs for general guidance only. It shall be the Contractor's responsibility to carefully review the applicability of the most recent USAB PVAG Guidelines with respect to the proposed overhaul designs and to design in accordance with all applicable Sections.

ADA passenger access (PVAG Section V206) is mandatory from the main deck bow loading area and main deck side loading areas, port and starboard, to all areas of the main deck passenger spaces, including the commissary counter, ADA-accessible passenger head, aisles between seating and table sections, luggage stowage racks, etc.

Aisle widths, wheelchair turning radii, table and seating configuration and construction, thresholds, door forces, etc. shall be carefully adhered to (PVAG Sections V221 & V802). It may be necessary to remove the two side-facing benches at the front of the main deck passenger area to provide the necessary turning radius aft of the bow loading doors.

The overhauled vessels shall each be equipped with one passenger head that is fully ADA accessible in all respects, including, but not limited to door width and force, turning radii, toilet configuration, transfer bars, sink, mirror, towel and tissue dispensers, and baby changing table (PVAG Sections V213 & V603, V604, V606, V609). It is anticipated that this may require the port side head to be expanded to the edge of the current commissary counter and a new door to be installed parallel to the front of the commissary counter.

The commissary counter shall be fully accessible (PVAG Sections V227, V308, V904).

Authority-approved, raised text/Braille signage shall be provided for all passenger accessible spaces, do not enter rooms/areas, etc. (PVAG Sections V216, V703). All communication equipment shall be designed and operated to ensure customer service information is broadcast in dual-mode (audibly and visually) (PVAG Sections V219, V706).

All interior passenger elements not specifically addressed by PVAG, shall conform with US DOT 49 CFR Part 37 (and Subpart C) as well as 49 CFR Part 39.

ADA Passenger Vessel Accessibility Guidelines can be viewed at:

<http://www.federalregister.gov/articles/2013/06/25/2013-14367/passenger-vessels-accessibility-guidelines>

The MBTA/BCIL agreement can be viewed at:

<https://cdn.mbta.com/sites/default/files/Accessibility/2018-12-04-mbta-bcil-amended-settlement-agreement-final.pdf>

The overhaul shall adequately address the requirements of PVAG Section V206 and all other applicable sections. The vessel provides for passenger boarding and debarking on the main deck only.

Within ninety (90) days of NTP, Contractor shall submit to Authority for approval, arrangement drawings to demonstrate compliance with ADA/PVAG requirements **[CDRL 4-1]**. The Contractor is under obligation to bring ADAAG conflicts or non-compliance issues to the immediate attention of the Authority if such situations are discovered.

004.5 CONTRACTOR'S OBLIGATION

The Contractor is to provide all plant infrastructure, labor, and transportation for shipyard employees, supplies as required, fuel for vehicles and machinery, water, power, lighting, air, steam, crane and forklift services, Contractor communications, line handling, wharfage, towing and shifting services, vessel security, and disposal of removed materials and supplies. This obligation shall include equipment and power services to prevent cold weather freeze up as well as adequate hot weather ventilation.

The Contractor is responsible for vessel supplies as required during overhaul, initial system energizing, cleaning, flushing, tests and trials, transport and delivery, including, but not limited to: fuel oil, lube oil, potable water, cooling system additives, filter cartridges, power, lighting, pressurized air, crane and forklift services, shipyard communications, line handling, wharfage, towing and shifting services. This obligation shall include equipment and power services to prevent cold weather freeze up, as well as adequate hot weather ventilation. This obligation encompasses all requirements of vessel transport and deliveries as detailed in Section 900.

Contractor is responsible for securing the vessel from damage while in the Contractor's care. This includes providing a secure storage area or security personnel, providing adequate fendering while moored at the Contractor's facility, and protection from severe weather. No

other vessel shall be moored alongside the Authority's vessel without the specific permission of the Authority.

The Technical Specification is intended to leave the Contractor free to provide its own detail design application for new or modified systems. The Contractor shall assume complete and overall responsibility for the satisfactory operation of such systems. The Contractor's responsibility includes but is in no way limited to; ensuring that the overhaul of the vessel and the vessel component parts are appropriate, coordinated, compatible and that they perform correctly, whether together or individually.

004.5.1 HEAVY WEATHER PLAN

The Authority has the option of requiring the Contractor to submit a written heavy weather plan in advance of a pending storm or of a storm season. The adequate protection and safety of the vessel during the time in care of the Contractor is a responsibility of the Contractor.

004.6 MANUFACTURERS' REPRESENTATIVES

Whether or not it is specifically stated in these Specifications, when it is required by the equipment manufacturer; by the specialized technical nature of the installation; for warranty purposes; or when work is outside the normal scope of the Contractor's work force; the Contractor is to provide the services of manufacturers' representatives. All Manufacturer Rep services shall be at the Contractor's cost. Assistance and expertise required for proper installation, on-line testing, calibration, adjustments, etc. shall receive certified Technical Support at the Contractor's expense. At a minimum, manufacturers' representatives shall be employed for supervision of the installation and testing of main engines, reduction gears, waterjets, generators, control systems, switchboards, and navigational electronics.

005 CORRESPONDENCE & COMMUNICATIONS

The Contractor shall provide the Authority with a copy of all communications relating to vessel overhaul which the Contractor has with regulatory bodies, in particular, the USCG Marine Safety Center (USCG/MSC) Washington, and the Local OCMI.

The Contractor shall invite the Authority to be present during all discussions which relate to the vessel overhaul and operation which are held with the attending USCG Inspectors or other representatives of the Local OCMI.

These documents and discussions may include, but are not limited to, the design, construction, rip outs, and relocations, installation of equipment and machinery, testing, sea trials, delivery, and operation of the vessel.

Requirements for planning, scheduling, drawings, material specifications, instruction manuals, etc. are detailed herein. The Contractor shall submit proposed Drawing, Correspondence, and Communication Procedures to the Authority for approval within 30 days after Contract Award **[CDRL 5-1]**.

006 DOCUMENTATION

The Contractor shall submit Proposal Drawings as an integral part of their response to the RFP. As the design is developed, the Contractor shall submit Contract Drawings to the Authority for review, comments, and approval per the drawing review process described in Section 007. It is also the Contractor's responsibility to submit drawings, as required, to the USCG Marine Safety Center (USCG/MSC) Washington (and subsequently to the Local OCMI when directed by USCG/MSC) for review, comments, and/or approval.

006.1 PROPOSAL DRAWINGS

The Contractor's response to the RFP shall include a Proposal Drawing Package as described in the Contract Terms & Conditions.

006.2 CONTRACT DRAWINGS

Contractor shall be responsible for preparation of standard drawing sheets with borders and title and application blocks. All drawings must be of a quality consistent with industry best practice.

All drawings shall be prepared on the Authority's standard size sheets or as mutually agreed to by Authority and Contractor.

All drawings shall include:

- **Title Blocks** - All drawings shall utilize the Contractor's standard title block in the lower right corner and the Authority's standard application block in the upper right corner. The Authority has the option to add a logo beside the Contractor's title block.
- **Unique Drawing Number** - Drawing numbers shall include the Contractor's assigned vessel job number, and an individual drawing designation.
- **Revision Level** – Each drawing shall include a revision level. With each released revision of the drawing, its revision level shall increase.
- **Bill of Materials** - All drawings shall include a Bill of Material with a numbering system for easy identification on the drawing. Bills of Material shall be carried on the drawings, or on attached sheets of the same size which shall bear the drawing number.
 - Piece part and assembly weights.
 - US equivalent materials.
- **Dimensions** – shown in both English and metric units
 - English units shall be shown consistently on all drawings in either inches and fractions, or inches and decimals. Decimals shall be shown with maximum of three significant

figures to the right of the decimal point as required. A one-inch mark ("") shall be shown to the right of each English unit dimension.

- Metric units shall be shown as millimeters and decimals. Millimeter units shall be accompanied by one blank space and the letters "mm" to the right of the figures.
- Dimensions shall be shown in one of the following forms:
 - i. English dimensions followed by metric dimensions, enclosed in parentheses.
 - ii. Where longitudinal space is limited, English dimensions shall be shown as the numerators, and metric dimensions in parentheses shall be shown as the denominators, in fractional format.
 - iii. Where longitudinal and vertical space is limited, English dimensions only, or no dimensions, and a distinctive symbol shall be shown on the view or detail, and metric dimensions shall be shown by a key on the bottom edge of the drawing.
 - iv. Contractor's standard format, if approved by the Authority.

006.3 REQUIRED DRAWINGS AND DOCUMENTS

The detail and extent of the Contract Drawing package shall be determined by the Contractor; however, the Contract Drawing package must include all drawings and calculation documents as required by USCG Marine Safety Center, and include at a minimum, drawings and calculations for any modifications to the vessels. The Authority's primary purpose for this review of the design information, drawings, documents and data are to determine whether the requirements of this specification have been met, and the suitability of the design for its intended purpose.

The Contractor shall submit to the Authority within 30 days of NTP, a master list of all contract drawings and documents indicating the title and revision of each, an updated version of this document shall be submitted to the Authority monthly [**CDRL6-1**]. It is expected that the drawing package will include, but is not limited to:

1. General Arrangement
2. Docking Plan
3. Emergency Evacuation Plan/Procedure
4. Fire/Safety Plan
5. Outboard Profile
6. Tank Capacity Plan

7. Tonnage Plan & Calculations
8. Performance Calculations
9. Weight Estimate
10. Stability Calculations
11. Intact & Damaged Stability Analysis
12. Machinery & Equipment Foundations
13. HVAC Systems Drawings & Calculations
14. Sea chests
15. Ladders & Gratings
16. Rails & Bulwarks
17. Corrosion Control Plan
18. Doors, Hatches, Windows, Manholes
19. Superstructure
20. Mooring & Anchoring
21. Tankage Plan
22. Machinery Arrangements
23. Sea Water Systems
24. Fresh Water System
25. Sanitary System
26. Fuel Oil System
27. Lube Oil System
28. Deck Drains
29. Vents, Fills, Sounding
30. Waterjet Installations
31. Bilge System

32. Fire Main System
33. Reflected Ceiling Lighting Plan
34. Receptacle Plan
35. Electronic Controls
36. Main & Generator Starting Systems
37. Navigation & Communications Systems
38. Pilothouse Mock-up and drawings
39. Ventilation Systems
40. Exhaust Systems
41. Shore Power
42. AC Electrical Load Analysis
43. AC One-line Diagram
44. DC Electrical Load Analysis
45. DC One-line Diagram
46. Electrical
 - a. Pilothouse
 - b. Commissary
47. Machinery Miscellaneous
48. FMEA or USCG approved equal
49. DVTP or USCG approved equal
50. PSTP or USCG approved equal
51. Sanitary spaces
 - a. ADA modification plan
 - b. Piping
 - c. Outfitting

52. Accessible and Priority Seating Areas
53. Passenger Space modifications
 - a. Seating and tables
 - b. Interior coverings (floor coverings, wall coverings, ceiling, etc.)
 - c. Crew storage areas
54. Counters & Commissary
 - a. Arrangement
 - b. Construction
 - c. Outfitting
55. Boarding & debarking areas, bridging mechanisms
56. Coamings and drainage
57. Switchboard Arrangement
58. Signage (including ADA, USCG and MBTA required markings)
59. CCTV
 - a. Coverage plan
 - b. System diagram
60. Boarding Area Cameras
 - a. Coverage plan
 - b. System diagram
61. Passenger Information System
 - a. Equipment locations
 - b. System diagram
62. Safety Device Installation and Storage
63. Final Deadweight Survey

006.4 INTERFERENCE & ACCESS

For all modifications to the vessels, the elimination of all equipment interference; and the location of machinery, pumps, piping, wiring, ductwork and miscellaneous equipment; to allow proper access for operation and maintenance, is the Contractor's responsibility. It is essential that the Contractor is aware of this obligation. The Contractor is responsible for ensuring that all modifications are arranged and constructed using "good shipbuilding practice" and that they adhere to the requirements of the CFR. The Contractor and the Authority are mutually responsible for the maintenance of ongoing communications, inspections, and approvals during construction.

Equipment and components that are to be installed shall be located in a manner that most readily facilitates operation and allows for ease of maintenance. Doors and panels must be capable of being fully opened. Sufficient clear space shall be provided in front of the main switchboard and power panels to allow for removal of components within. Sufficient space shall be allowed around equipment to allow for standard maintenance.

A maintainability demonstration shall be required per **Section 0.11.6 Maintainability Demonstration** for any modifications.

006.5 ENGINEERING

The Contractor is responsible to provide competent and professional construction, engineering and design support to overhaul the vessel.

Notwithstanding any requirements of these Specifications, it shall be the Contractor's sole responsibility to determine and develop working drawings, which shall be necessary to complete the overhaul and delivery of the vessel. Working drawings shall be made available for timely inspection, comments, and approval by the Authority.

Any overhaul details that are not shown on the Contract Plans (commonly referred to as "Working Drawings" or "Yard Sketches") that shall be required for fabrication and/or overhaul guidance shall be developed by the Contractor and shall be approved by the Authority and, when required, by the USCG.

The Contractor shall provide sufficient and well-developed details to Authority prior to the overhaul of the specific area in question. This requirement is particularly applicable to foundation sketches for all significant pieces of machinery that are added, modified, or relocated.

When the Authority grants approval to the Contractor for installation of a different (or equal) piece of equipment other than specified, per the terms and conditions of Section 0.2.2.5 or 0.2.2.6, the Contractor shall be responsible to revise any and all drawings, calculations, integration analyses and other documentation associated with the installation of the equipment.

006.5.1 CONTRACTOR'S REPRESENTATIVE (ENGINEERING & DESIGN)

The Contractor's proposal shall designate the individual who will serve as the Contractor's Representative for this Contract. Within ten (10) days of NTP, the Contractor shall notify the Authority of the Contractor Representative's contact information **[CDRL 6-2]**. This individual shall serve as the contact person (POC) between the Authority and the Contractor in matters of engineering and design until another individual is so designated.

0.6.5 DEVIATIONS

In Contractor's drawings and calculations, the Contractor shall invite attention to all departures from the Contract Drawings, Specifications, and subsequent letters of instruction received from the Authority.

In any instance where "deviations" exist and are not specifically noted, a mere review by the Authority shall not constitute authorization for such "deviation". The Contractor bears the ultimate responsibility for material supply, installation, conversion, and proper operation of the vessel, its parts and equipment. Both the Contractor and the Authority shall maintain close communications throughout the entire Contract period to further the goal of satisfying all aspects of the Contract in a mutually satisfactory manner.

006.6 AS-BUILT DRAWINGS

Within 30-days following **delivery** of the vessel to Authority, the Contractor shall provide the Authority with a full set of "AS-BUILT" drawings for any modifications, (10) copies on PDF file CD for that vessel **[CDRL6-3]**. The Authority will certify that these As-Built drawings will be used only for purposes of maintenance and repair on the Contracted vessel as delivered and shall not be made available to other owners, shipyards, or contractors for the construction of subsequent vessels. The "As-Built" drawing package shall be received and approved by the Authority prior to the release of final contract installment payment monies on the vessel delivered.

006.7 MANUALS AND MAINTENANCE INSTRUCTIONS

No later than 10 days prior to delivery of the first overhauled vessel to the Authority, the Contractor shall provide the Authority with five (5) copies of all vendor instruction manuals, equipment cut sheets, engine and machinery manuals, parts lists/manuals, and equipment information brochures for any new or modified equipment or machinery. Loose cut sheets and manuals of just a few sheets shall be combined into 3-ring binders and indexed. **[CDRL 6-4]**.

A complete set of maintenance instructions specifically prepared for this Contract that are to be incorporated into the Maintenance Instruction Book, including all cut sheets and diagrams, shall be submitted for review by the Authority no later than thirty (30) days in advance of delivery of the first vessel. **[CDRL 6-5]**

Thirty (30) days prior to the delivery of the vessel, the Contractor shall submit to the Authority for review and approval, an Operator's Manual for new or modified systems or components **[CDRL 6-6]**. USCG NVICs 01-91 and 05-01 shall be used for guidance as to applicable topics suitable for inclusion in the Operator's Manual, including crew responsibilities. The manual shall include step by step start up and shut down procedures; operation procedures of all auxiliary equipment; system and equipment maintenance tasks; and a preventative maintenance schedule. Five (5) copies of the Operator's Manual shall be provided for the vessel in electronic CD format.

006.8 VESSEL HISTORY BOOKS

The Contractor shall furnish to the Authority an 8.5 in. x 11 in. (216 mm x 279 mm) loose-leaf type Vessel History Book for the vessel, the pages of which shall be reproducible by black and white print process. Contractor shall confer with the Authority to the format of this book, which shall include, but is not limited to:

1. Vessel Name, Official Number, Hull Number, and other identifying information
2. Equipment serial numbers
3. Tests & Trial reports
4. USCG Marine Safety Center communications
5. USCG Local OCMI communications
6. USCG Inspection reports
7. Regulatory Body reports and certifications
8. QA reports
9. Yard Progress Logs
10. Meeting Minutes

It shall be the responsibility of the Contractor to employ an acceptable system of configuration control in keeping individual Vessel History Books current throughout the construction and testing process.

The Vessel History Book shall be delivered incorporating serial record data as soon as practical **[CDRL 6-7]**, but no later than delivery of each overhauled vessel to the Authority.

006.9 PHOTOGRAPHS

The Contractor shall provide the Authority with a photographic record of the overhaul process for the vessel. General photos of progress shall be taken weekly, photos of special events shall be taken at the time of the event. Photographs shall be and submitted to the Authority

monthly through email or other file transfer method to be mutually agreed upon by the Authority and the Contractor. All photos shall be placed on CDs or DVDs in JPEG format, or another format approved by the Authority, labeled, and provided to the Authority within 30 days of each vessel's delivery for inclusion in the vessel construction records **[CDRL 6-8]**.

006.10 MASTER SCHEDULE AND PROGRESS UPDATES

The Contractor shall perform planning and scheduling functions as required to establish an orderly and systematic construction program and to facilitate completion of the Contract work. The Contractor shall submit construction schedules and progress reports to the Authority at mutually agreed time intervals.

As an integral part of the Contractor's Bid Package, the Contractor shall provide a Preliminary Master Schedule. Within 30 days following the Contract Award, the Contractor shall provide the Authority with a Master Schedule **[CDRL 6-9]**.

CONTENTS

The Master Schedule shall be in sufficient detail to provide:

1. Proposed start and completion dates for the preparation of drawings and technical data
2. Procurement activity including preparation of technical specs for long lead time items
3. Manufacturing lead time and shipping time for long lead time items
4. Shipyard prefabrication and subassembly interval schedule
5. Shipboard erection, major equipment installation, outfitting and testing schedule
6. Progress review meeting tentative schedule (See Section 0.15)
7. Such other activities as required by the Authority and passed to the Contractor for inclusion.

FORMAT

The Master Schedule shall be generated in a Gantt Chart format float that shows:

1. Predecessors and successors
2. Links
3. Revisions from original schedule +/- in separate column
4. Change Order delay days with overall impact to schedule

SCOPE

The scope of the Master Overhaul Schedule shall be broad enough to include:

1. Removals
2. Fabrications
3. Joiner work (ceilings, bulkhead panels, deck coverings, commissary equipment, refurbishments)
4. The scheduling of principal ship system modifications (electrical distribution, piping, HVAC).
5. Details of anticipated receipt and installation dates for long lead time items including, but not limited to:
 - Windows
 - Main Switchboards
 - Pilothouse Consoles
 - Generators
 - Passenger furnishings
 - Navigation electronics

If a Bidding Contractor has any question concerning the ability to perform due to any reason, and in particular due to equipment lead times and delivery dates which may have been defined over the course of Bid preparation, the Contractor is under obligation to inform the Authority of such potential issues with their bid submittal. The lag between bid submittals and Contract award could be a critical path that would recommend rescheduling of a particular Contract task. A recommendation during the Question and Answer period as set forth in the Contract to OFE a particular item rather than to include the item as provided in these Technical Specifications will not be considered detrimental to the Bid; however, it will be considered by the Authority and all potential bidders will be notified of any decision made.

It is intended that the Master Schedule will depict as accurately as possible the over-all planning and scheduling of the entire scope of Contract work. The Master Schedule shall be marked up at the end of each work week by the CONTACTOR and provided to the Authority for review, monthly updates shall be fully updated in the scheduling software. The Contractor and Authority shall perform a once-a-month in-depth review of the Schedule.

When, at any time during the Overhaul Contract, progress substantially deviates from the latest approved Master Construction Schedule, the Authority may request that the Contractor prepare and submit a revision.

006.11 EQUIPMENT LIST

At delivery of each vessel, the Contractor shall provide an equipment list detailing ALL purchased or overhauled machinery and equipment with general characteristics, model number, serial number, part number, manufacturer name and address, associated system and location on the vessel. **[CDRL 6-10]**

007 DRAWING REVIEW PROCESS

007.1 OVERVIEW

The design of the vessel overhaul shall be provided to the Authority for review and comment through the submittal of design packages (see Section 007.2) in a formal review process. Contractor shall develop a design package for each system on the vessel, including, but not limited to those listed in Section 007.2.2.

The review process includes three formal design review phases, listed below. The level of detail required for each design package increases as the design progresses from Conceptual Design to Final Design.

- **Conceptual Design Review** – provides general overview of the complete vessel and all major systems to form an agreement on the general functional, design and performance requirements within the scope of the contract.
- **Preliminary Design Review** – one for each system or part of the vessel to review the detailed system design and allow for Authority comment.
- **Final Design Review** – one for each system or part of the vessel to review the detail design that addresses the Authority's comments from the Preliminary Design Review.

The Authority may choose to review design submittals and respond via written correspondence. However, for more complicated systems, it may be necessary for the Contractor to participate in design review meetings with the Authority at which systems and concerns can be discussed in greater detail to resolve issues quickly

007.2 DESIGN PACKAGES

007.2.1 DESIGN PACKAGE CONTENTS

Design packages for any new system or modification of existing system shall include, at a minimum:

- System Functional Description which shall describe the system's composition, functionality, design criteria, and any other information required to understand the system and its conformance to the Authority's specification, including any applicable regulations and standards.

- Complete drawings package for the system, meeting the requirements of Section 006.2.
- Electrical, pneumatic or other schematics, where modified.
- Calculations and Safety analyses, where applicable.
- Any other information necessary to fully convey the concept and details of any changes to the vessels as well as conformance to the Specifications.

007.2.2 REQUIRED DESIGN PACKAGES

Contractor is required to provide design packages covering all aspects of the vessel overhaul, including, but not limited to the following, only where modifications are made:

- Structural changes, if any
- Hull repairs
- Superstructure repairs
- Tanks
- Propulsion – engines, jets, reverse/reduction gears, steering control
- Ship's service power (gensets)
- Fuel oil & lube oil system
- Exhaust systems
- Electrical systems - electrical load analyses and one-line diagrams, mechanism to prevent use of shore power and generator power simultaneously, batteries & chargers, power distribution, electrical components
- Lighting
- Navigation electronics
- Communication systems, including passenger information system
- Engine & Vessel Monitoring systems
- Safety systems
- CCTV

- Piping and insulation
- HVAC – including layover/protective heaters
- Plumbing - bilges & fire pumps, sea chests, potable water & sewage systems
- Hull fittings – windows and doors, etc.
- Rails, stanchions, ladders & stairs, gates
- Hatches, Scuttles, Emergency Escape Hatch
- Interior outfitting – floor coverings, ceiling panels, seats, tables, etc.
- Commissary
- Heads
- Painting & Styling (interior & exterior)
- Cathodic protection
- Pilothouse (including mock-up)
- Bridge plate
- Ticket Counter
- Bicycle Rack
- ADA/PVAG Accessibility

Contractor may elect to modify the grouping of information in design packages to match the Contractor's design process, but all modified systems must be represented in the design packages. All drawings and documents required by Section 006.3 must be submitted as part of a design package.

007.3 DESIGN REVIEW PROCESS

The following describes of the steps in the design review process:

007.3.1 CONCEPTUAL DESIGN REVIEW (CDR) – WITHIN 45 DAYS OF NTP

Contractor submits a conceptual design review package which presents an overview of the vessel and major systems, including their functionality and features.

At the time of the conceptual design submittal, a Conceptual Design Review Meeting shall be scheduled at a date and time mutually agreeable to the Authority and the

Contractor. The Conceptual Design Review Meeting shall be no earlier than 15 business days after submittal of the revised design package.

During the Conceptual Design Review Meeting, the Contractor shall present the conceptual design of the major systems. Discussion of the concepts between the Contractor and the Authority shall inform future revisions of the design for each system and shall include an early identification of system interfaces that require coordination.

The Authority will draft minutes and action items from the Conceptual Design Review meeting and circulate them to the Contractor via formal letter for concurrence.

007.3.2 PRELIMINARY DESIGN REVIEW (ONE PER SYSTEM)

The Preliminary Design Review process shall consist of the following steps:

Contractor Submits Preliminary Design Package (one per system)

For each system on the vessel, the Contractor shall submit to the Authority a preliminary design package incorporating the Authority's comments from the Conceptual Design Review Meeting. All drawings and documents required by Section 006.3 shall be submitted via one of the design packages.

All design and engineering drawings, revised or original, submitted to the Authority by the Contractor for review shall be in PDF format. The PDF version (release) used shall be mutually agreed upon by the Authority and Contractor. PDF drawings shall be scalable.

Where the Contractor elects to develop their design in a 3D modeling software, the 3D model shall be converted into 2D drawings to be submitted as part of the design package.

Authority Responds to Preliminary Design Package (per system)

The Authority shall review and respond to the Contractor design submittal as rapidly as possible – ten (10) working days average time from receipt. Authority's response shall provide comments or questions about the design and shall indicate to the Contractor that a drawing submitted falls into one of the following categories:

- Conforms.
- Conforms as Noted.
- Revise as Noted and Resubmit.
- Rejected - Resubmit.
- Review Not Required.

Interim Revisions of Design Packages – as required (per system)

Contractor shall promptly revise drawings, schematics, and documents designated other than “Conforms” or “Review not Required” per the Authority’s comments. In addition, Contractor shall advance the design such that it adequately addresses all specification and regulatory requirements, interfaces and other requirements to develop a final design.

007.3.3 FINAL DESIGN REVIEW (ONE PER SYSTEM)

Contractor Submits Final Design Package (one per system)

For each system on the vessel, the Contractor shall submit to the Authority a final design package incorporating the Authority’s comments from the Preliminary Design Review and any interim revisions, and including all additional detail required to fully describe the final design and any integration with other systems on the vessel.

Finalization of Design Package (per system)

The Contractor shall make any final revisions to the final design per the Authority’s formal comments. The revised package shall be resubmitted to the Authority.

The review cycle shall continue, if required, until the complete design package receives a status of “Conforms”.

Acceptance of the Contractor's drawings and data by the Authority shall be for general detail and arrangement only and shall not relieve the Contractor of any responsibility including, but not limited to, responsibility for accuracy of dimensions and details.

The Contractor shall remain responsible for agreement and conformity of its drawings and data to the Contract Documents and Specification.

All design reviews for a specific item/system shall be successfully completed before the Authority will participate in associated First Article Inspections (see Section 900).

007.3.4 DESIGN REVIEW MEETING(S) - AS REQUIRED

Throughout the design review process, when open issues would be more quickly resolved via a verbal discussion, Authority has the right to request a design review meeting, either in person, or via web meeting.

A design review meeting is intended to allow a detailed discussion of the design package and concept and to allow for clarification of any unclear items to expedite the resolution of any open issues.

For budgetary purposes, Contractor shall assume five (5) in person design review meetings throughout the project at an Authority-designated location in the Boston, MA area.

Design Review Meetings shall be scheduled at a date and time mutually agreeable to the Authority and the Contractor. Determination of whether to use an in-person, phone, or web meeting will be based on the complexity of open issues and the ability to effectively communicate the information needed to resolve those issues. For in-person meetings requiring air travel 14 days' notice shall be provided.

At design review meetings, the Contractor shall have in attendance technical staff with the ability to answer detailed technical questions and explain the design as well as senior staff with the authority to make decisions and initiate work related to those decisions.

The Authority will draft minutes from the design review meetings and circulate them to the Contractor via formal letter for concurrence.

007.4 USCG COORDINATION

The Contractor shall be responsible for submitting drawings, as required, to the USCG Marine Safety Center (USCG/MSC) Washington (and subsequently to the Local OCMI when directed by USCG/MSC) for review, comments, and/or approval. Changes to the Contract Drawings as required by USCG Comments will be made and resubmitted by the Contractor.

Although the Authority's comments are expected to be addressed by the Contractor in their designs, where conflicts exist, the comments of the USCG shall prevail over comments of the Authority. Contractor shall keep the Authority apprised of USCG comments and required changes and shall provide the Authority with copies of all USCG communications of "Approval", "Examined", and "Returned for Revisions".

008 WEIGHT AND CENTER OF GRAVITY

The Contractor shall be responsible for maintaining an ongoing record of any changes to the weight, VCG, and LCG characteristics and freeboard of the vessels, as measured in the pre-overhaul deadweight survey performed by the MBTA (see Appendix D). Modifications which affect the weight, VCG, and LCG shall not be undertaken until the Contractor has submitted to the Authority an estimate of the effect that such departures will have on the vessel's weight and service speed. It is critical that the structural design limit is not exceeded. The Authority is responsible to provide the Contractor written approval in writing for weight increases and final freeboard measurement.

The Contractor shall be responsible to track changes to the vessel's weight, CG and freeboard by updating the weight estimate monthly throughout the construction process. Within 30 days of NTP the Contractor shall submit the format of report to the Authority for review. **[CDRL 8-1]** The updated weight estimate shall be provided to the Authority monthly for review.

Weight changes shall be calculated in aggregate where a weight removed and a weight added are combined. Contractor shall be responsible for documentation of these changes in a revised Stability Book; and submittal of this document to USCG/MSC for review and approval. The

Contractor shall include these deadweight surveys, stability book revisions, and submittals in the Vessel History Book.

NOTE: It is essential that all passenger and crew weight calculations conform to the USCG requirement that each person be calculated at (185) pounds.

Revised deadweight data shall be submitted to USCG's MSC by the Contractor. The weight estimate will be verified through the weight survey required to be performed on each vessel prior to Sea Trials (see Section 981). Prior to vessel delivery a comparison of the final weight estimate to the weight report from the vessel survey shall be provided to the Authority and the attending USCG Inspector, along with the weight report developed from the weight survey for each vessel. **[CDRL 8-2]**

009 STABILITY AND SUBDIVISION

009.1 SUBDIVISION

The overhaul shall not in any way negatively affect the ability of the vessels to meet the subdivision, intact stability, and damage stability requirements of 46 CFR Subchapters "S" and "T". The overhaul shall not negatively affect the ability of the vessels to comply with the requirements for Collision Bulkheads in each hull per 46 CFR 179.310. The Contractor shall obtain and post an updated post-overhaul Stability Letter in the pilothouse certification display case, (Reference Section 0.3.3.1).

009.2 ACCESS AND LOGISTICAL REQUIREMENTS – STABILITY AND SUBDIVISION TESTS

The Contractor shall prepare and make the vessel available for the weight surveys called for in Section 900. The Contractor shall provide adequate ventilation and access to all spaces and a "Competent Person" with the necessary equipment to ascertain the gas free condition of spaces and adequacy of oxygen levels. The Contractor shall provide adequate temporary lighting and necessary incidental labor as required.

011 ACCESS & MAINTENANCE REQUIREMENTS

011.1 GENERAL

The arrangement of all machinery and equipment shall be maintained or improved, so far as possible, to permit ready access to all parts for operation, inspection, maintenance and repair without removal or disturbance of other structure or equipment. Ladders, doors, manholes, scuttles, bolted plates, etc. shall be maintained for access and should not be modified in a manner that creates a tripping hazard.

In no case shall grating/floor plate support, hangers, wireway supports or other miscellaneous structure be attached by welding to any equipment or machinery unless specifically approved by the respective manufacturer and by the Authority. Equipment such as switchboards, transformers, pumps, etc., shall not be welded to deck structure unless specifically approved as described above. No maintenance shall require the vessel to be hauled out more frequently than the USCG-required 2-year inspection. The maintainability demonstration (Section

0.11.6 Maintainability Demonstration) shall include review and demonstration of these design elements. Within 90 days of NTP, Contractor shall submit to the Authority a plan for how the maintainability will be demonstrated.

011.2 PIPES, VALVES, ETC.

Restriction of access openings by pipes, valves, etc. is unacceptable. Pipes, ventilation ducts, Controls, valves, etc., shall not be located or relocated into areas rendered inaccessible by the positioning of other fittings. All systems including piping, ductwork, hangers, etc., in way of areas designated as temporary access will be installed so that they shall be readily removed without burning or cutting. Wireways shall not block temporary access areas.

Where valves or other equipment that requires frequent attention are installed or relocated below floor plates, those floor plates or portions thereof shall be fitted with hinges to provide easy and safe access. Nameplates shall be provided and installed to the approval of the Authority to identify locations of under floor plate valves and/or equipment.

011.3 REMOVAL OF EQUIPMENT/MACHINERY

Where provisions have been made to make decks, bulkheads, etc., removable for access to or for the installation or removal of main engines, generators, shafting, machinery, parts, or other equipment, this functionality shall be maintained after overhaul.

Special attention shall be made to provisions for removing the main engines and gensets. No new interferences in way of engine removals including insulation, plumbing, lighting, electrical cable runs, etc. shall be designed into the vessel. Where interferences are unavoidable, they shall be easily disconnected and removed.

The maintainability demonstration (**Section 0.11.6 Maintainability Demonstration**) shall include review and demonstration of these design elements.

011.4 DRAINAGE

All modifications in areas prone to accumulation of water or oil shall be designed to prevent such accumulation, or where unavoidable, adequate drainage shall be provided. All areas of tanks and voids that are accessible for inspection prior to overhaul shall remain accessible after overhaul.

0.11.5 HEADROOM

The headroom in passenger spaces, crew work areas, machinery spaces, voids, etc. shall be maintained as the minimum according to the existing vessel's structure and outfit.

0.11.6 MAINTAINABILITY DEMONSTRATION

The Contractor shall demonstrate to the Authority the physical ability to perform regular operation, servicing, and maintenance of all mechanical and electrical equipment newly installed or modified through the overhaul while in their installed locations. The ease of

maintenance and operational efficiency shall be maintained or improved through the overhaul. Physical access by normally fit and sized personnel to fuel, air, and oil filters, oil change locations, valves, electrical panels, switchboard accesses, lighting, emergency equipment, ladderways and emergency escape routes, fire suppression systems, gauges and sensors, communications, and miscellaneous equipment shall be demonstrated to be reasonable and compatible with marine industry standards and USCG requirements. Sufficient lighting for maintenance locations shall be demonstrated to the approval of the Authority.

A Maintainability Demonstration Plan [**CDRL 11-1**] shall be submitted for approval within 90 days of NTP. The Contractor shall submit within the plan, a list of Lowest Replaceable Units (LRUs), and the Authority shall select items to be demonstrated from this list. The Contractor shall assume that a minimum of 30% of all new or modified LRUs shall be subjected to Maintainability Demonstration. The maintainability demonstration shall be conducted on assemblies, components, and subsystems selected by Authority [**CDRL 11-2**] no later than 30 days prior to the transit of vessel from the Contractor's facility to the Authority.

012 ACCESS TO YARD/VESSEL/DOCUMENTS

012.1 ACCESS TO YARD/VESSEL

The Authority shall be afforded access to the Contractor's Shipyard, the Authority's on-site office, and the vessel during yard working hours, including all shifts, until the vessel departs the Contractor's facility for her designated delivery port.

The Authority reserves the right, at no additional cost to the Contractor, to witness ALL work at any point in the performance of the CONTRACT and/or to audit and verify that the performance of all work complies with the documentation, policies, and procedures which are a part of this CONTRACT.

012.2 ACCESS TO DOCUMENTS

The Authority shall have ready access during normal working hours to all documentation concerning the vessel including, but not necessarily limited to: Drawings; Specifications; Technical Information; Engineering Calculations; Schedules; Test & Inspection Reports; Relevant Subcontract Documents; Regulatory Body Reports; Approvals; Recommendations; and the Contractor's Detailed Contract Estimate. The Contractor's Detailed Contract Estimate shall be viewed only in the presence of the Contractor's representative. The Detailed Contract Estimate shall not be copied and shall not be removed from the Contractor's possession.

013 OFFICE

The Authority shall be provided with office space at Contractor's facility as described herein. This space shall have adequate electrical, telephone, and broadband internet outlets for office equipment including computers, and telephone equipment. Adequate lighting, heat, and air conditioning shall be provided. Telephone and internet connectivity charges shall be to the Contractor's

account. The office spaces described in 013.1 Office and 013.2 Conference Area should be located within easy walking distance of the vessel. An office trailer meeting these specifications will be sufficient.

013.1 OFFICE

An office with lockable door shall be provided and shall, at a minimum, include:

- (1) Office desk w/drawers & swivel chair
- (1) Side chair
- (1) File cabinet (4 or 5 drawer legal size)
- (1) Private telephone w/speaker phone capability and local/long distance, outside line
- (1) Table of sufficient size to lay out full size drawings with chairs
- (1) High Speed internet connection

Access to a nearby men's and women's (or unisex) restroom facility

Direct 24-hour, 7-day access to office by automobile.

Daily cleaning service

Access to a copier machine and facsimile transmission (telecopier) service.

013.2 CONFERENCE AREA

Upon prior notice and specific reservation request, the Contractor shall make available a Conference Area, which provides adequate space for meeting with vendors, yard personnel and other persons employed by the Authority.

013.3 PARKING

Convenient parking space will be provided for the Authority and its representatives well clear of grit-blasting and painting areas. Two designated parking spots shall be marked as reserved for this construction project.

015 PROGRESS REVIEW MEETINGS

The Contractor and Authority shall hold progress review meetings every one (1) to two (2) weeks per mutual agreement. These meetings shall be conference calls or held at the Contractor's facility or such other location as approved by both parties. Meetings will commence no later than two (2) weeks after NTP. The purpose of the meetings is to discuss, report, and resolve problems relative to progress, anticipated delays, cost experience in relation to budget and projected end costs, staffing, schedules, receipt of OFE (if any), Contractor-furnished material, production problems (including Subcontractor problems), and other related matters.

016 WARRANTIES

All warranties shall be as detailed in the Terms and Conditions. All parts, components or other items in the vessel that are overhauled, modified, or newly installed, shall be warranted for parts and labor, beginning with the conditional acceptance, for **one year (12 months)**.

All warranty communications shall go to the Contractor who is the ultimate warranty entity. At the completion of the warranty period, the Contractor shall provide the Authority with a vendor list to enable the Authority to communicate with vendors and sub-contractors in the future for maintenance, operational issues, etc. The Vendor List shall contain: vendor name, contact person's name, address; telephone, e-mail address; purchase order (with cost information redacted) or Contract number (with cost information redacted); equipment model and serial numbers.

017 MATERIALS & WORKMANSHIP

017.1 MATERIAL - GENERAL

Material, unless otherwise specified herein, shall be of commercial quality; suitable for marine environment; and shall conform to ASTM, SAE, ABS or DNV, and USCG (CFR) requirements. This material shall be so designated on Bills of Material and on Construction Drawings. All materials shall be new and of first-class quality. All materials shall be free from imperfections of manufacture and from defects, which adversely affect appearance or serviceability.

All new aluminum installed on the vessels shall be of plate thicknesses class, and scantling size as the material replaced, generally, this will be 5083-H116, but the proposed material shall be submitted for Authority approval. Unless otherwise specified, against shipbuilding best practices or regulatory requirements: all hardware shall be stainless steel.

017.2 WORKMANSHIP - GENERAL

All workmanship shall be first-class in all respects. All material, machinery, equipment, pieces and/or parts specified herein and installed in the vessel shall be suitable for the marine service intended.

The Contractor shall make all reasonable efforts to select products and components for use in the vessel that would be expected to be supported by their manufacturers for ten (10) years after the date of vessel acceptance. Should this not be possible, as in the case of software, or should a part for which there is no competitive equivalent available in the market place become unavailable through the Contractor during that time period, the Contractor agrees to assist the Authority with drawings and specifications to facilitate component procurement by the Authority when necessary.

Penetrations shall not be cut in strength members for pipes, wiring leads, vent trunks, etc., unless no reasonable alternative exists. When such penetrations are required, compensation shall be fitted to maintain original strength characteristics. USCG approval is required for strength member penetrations.

017.3 STORAGE/PROTECTION

All material and equipment intended for the vessels in any form – whether Contractor or OFE or removed from the vessel for reinstallation after overhaul – shall be adequately stored and protected from the elements and shall be given appropriate security by the Contractor. The Contractor is responsible for the proper handling, protection and storage of all materials, as defined below:

- Proper “handling” – the physical and orderly removal and replacement of equipment and the orderly inspection and inventory of this equipment.
- Proper “protection” – the packaging and arrangement of equipment to protect it from damage or deterioration during moving and storage. This includes equipment and structure being removed as well as items remaining in place that could be damaged during the removal or installation of other equipment or structure.
- Proper “storage” – the lay-up of equipment under conditions that will guard against rot, mildew, temperature degradation, denting, scratching, vandalism or other damage so that the equipment will be in essentially the same condition when it is reinstalled as when it was removed or purchased.

Due consideration shall be given to the nature of each piece of equipment or material with storage and security mutually agreed upon by the Authority and Contractor. Inside, secure, and weather protected storage shall be provided for all equipment and material that will be located on the interior of the vessel and for equipment such as radar antennas, floodlights, spotlights, etc. that could be sensitive to damage.

OFE equipment, if any, shall be received, inspected for completeness and damage, and stored according to these Specifications. The Authority shall be notified of the receipt of major pieces of equipment and its availability for inspection in conjunction with the Contractor’s representative.

The Contractor shall, as soon after transport of the vessel to the Contractor’s venue as practicable, remove any signage, advertising frames, informational documents attached to interior joiner work, and other miscellaneous tools and equipment that is deemed to be at possible risk of loss or damage. These shall be inventoried with locations referenced, packed in bubble wrap (where appropriate), boxed, and labeled. They shall be placed in secure storage to the approval of the Authority. The inventory shall be provided to the Authority. Upon completion of new joiner work installation, if requested by the Authority the removed items shall be reinstalled by the Contractor in locations to the approval of the Authority.

The Contractor shall be responsible during construction and prior to vessel delivery for the protection of all pre-existing, installed items and new items with finished surfaces, such as joiner panels, door frames, deck coverings, carpeting, joiner ceilings, countertops, furniture, etc.

The Contractor shall provide protective floor covering for all passenger aisles and/or walkways within construction areas and in areas leading to and from construction areas. These temporary floor coverings shall be heavy duty matting, plywood “skins”, or some such similar protective covering. The selected material is subject to Authority approval.

Any soft material areas, such as (but not limited to) upholstery and carpeting, damaged by the Contractor or Contractor's Agents during course of this Contract, will be replaced at the Contractor's expense.

Fragile and high value items shall be removed from the vessel for storage during rip outs and construction. They shall be stored to the approval of the Authority. Items such as monitors, amplifiers, radios, keyboards, etc. shall be wrapped in bubble wrap and stored in climate-controlled storage. The Authority shall be afforded reasonable access to this storage area.

If the Contractor does not have existing enough dry and secure inside storage capacity, it may be necessary to provide rented mobile or semi-portable storage units. It shall be the Contractor's responsibility to see that storage warehouses or containers are not susceptible to wind, water, heat, freezing, mildew, theft or other loss or damage and that these storage spaces are readily accessible to both the Contractor and the Authority for periodic inspections of inventory; measurements of equipment; and/or additions to or removals of equipment. It is the responsibility of both the Contractor and Authority to sign in or sign out inventory so that an accurate accounting of on-hand vessel equipment and accoutrements can be maintained.

017.4 WELDING

Aluminum welding shall be of electric pulse arc Metal Inert Gas “MIG” or Tungsten Inert Gas “TIG” type process as appropriate. Welding preparation and execution comply with USCG or Class Society requirements and be performed by AWS certified welders meeting all USCG requirements.

018 QUALITY ASSURANCE

018.1 CONTRACTOR QUALITY MANAGEMENT SYSTEM

Definition and Objective – The Quality Management System (QMS) is the organizational structure, procedures, processes and resources needed to implement the management and assure quality program conformance of the product quality throughout the life of the project. The Quality Management System is comprised of:

018.1.1 QUALITY MANUAL

The Quality Manual is a document which, at a minimum:

- Describes the system, including the approach to quality.
- States the Quality Policy.
- Commits to quality.

- Lists authorities, responsibilities and inter-relationships, including the reporting structure.
- Includes or refers to procedures.
- Outlines the contractors' relationship with subcontractors and suppliers.
- Binds all contractor divisions, groups, and affiliates to the same Quality management system.

018.1.2 PROJECT QUALITY PLAN

The Project Quality Plan supplements the Quality Manual and sets specific quality practices, resources and sequence of activities relevant to a particular project or contract. The quality plan is the bridge connecting generic system quality manual procedures to specific requirements of the project or contract. The quality plan is supplemented by specific work instructions and procedures.

The Project Quality Plan provides detailed subcontractor and supplier quality responsibilities. The plan will specifically show required subcontractor and supplier quality submittals, procedures, and manufacturing plans.

The Project Quality Plan will bind subcontractors and suppliers to be held accountable to the same quality requirements as the contractor.

018.1.3 INSPECTION AND TEST PROCEDURES

Inspections shall be performed per Section 900. For every test performed on the vessel, a test procedure shall be submitted to the Authority for review and acceptance, by the deadline indicated in **Table 1**.

018.2 QUALITY DOCUMENT SUBMITTALS

018.2.1 CONTRACTOR QUALITY DOCUMENT SUBMITTALS

The Contractor is required to submit his quality management system documentation to the Authority for acceptance on the following schedule:

Table 1: Required Quality Submittals

Quality Submittal	Submittal Deadline
Quality Manual [CDRL 18-1]	Within 30 days after NTP
Project Quality Plan [CDRL 18-2]	Within 60 days after NTP
Project Inspection Plan (See Section 018.5) [CDRL 18-7]	Within 60 days after NTP
Inspection & test procedures	Min. 90 days prior to use

018.2.2 SUBCONTRACTOR QUALITY DOCUMENT SUBMITTALS

Subcontractors/suppliers of major, primary or critical systems, subsystems and/or components shall submit for approval: quality plans and all inspection and test procedures.

Subcontractors/suppliers shall be subject to the schedule in **Table 1** above, as applicable. A change of supplier or supplier affiliates manufacturing components will require supplier and component requalification.

018.3 CONTRACTOR QUALITY ASSURANCE DOCUMENTATION

018.3.1 IMPLEMENTATION AND AVAILABILITY

The Contractor shall implement a Project Quality Assurance Plan as a part of his Quality Management System and those of his Subcontractors and suppliers as applicable.

The Project Quality Assurance Plan shall include provisions for material and procedure review.

018.3.2 MINIMUM CONTENTS

The Project Quality Assurance Plan shall consist of the documented procedures, policies, plans and organization activities of the Contractor, Subcontractor, manufacturers, and suppliers, which shall assure all work, materials, test, and documentation conform to the requirements of the Contract and specifications. The quality assurance plan shall be supported by detailed project work instructions.

Within sixty (60) days after award of the Contract, the Contractor shall submit to the Authority, for acceptance, a written Quality Assurance Plan (See **Table 1**).

018.3.3 CONTRACTOR'S ORGANIZATION CHART

Contractor's organization chart shall be submitted along with its proposal and resubmitted within 30 days of NTP [**CDRL 18-3**] and shall show the lines of authority and responsibility within the organization for quality assurance and its relationship with other functions.

Titles and names of key personnel shall be provided in a matrix with telephone numbers, addresses, fax numbers and email addresses.

The Authority shall be notified, in advance, of any changes of titles, names, or assignments of responsibility during this Contract, including all warranty and retrofit programs.

018.3.4 DESIGN CONTROL

The Contractor and suppliers shall establish and maintain documented procedures to control and verify design of products and services.

The Contractor shall schedule and conduct design reviews for all major systems and the complete vessel, including system integration. Equipment and systems subject to design reviews shall be identified in the Contractor's Quality Assurance Plan.

The Authority shall participate in all design reviews.

018.3.5 SYSTEM INTEGRATION

The Contractor shall identify a specific engineer as the responsible party for System Integration **[CDRL 18-4]**:

- The System Integrator shall be an Electrical or Mechanical Engineer and shall be dedicated to resolving all systems integration issues.
- The System Integrator shall be responsible for identifying software, electrical and mechanical interfaces of the subsystems to the vessel.
- The System Integrator shall be responsible for identifying the interfaces of the vessel to the environment.
- The System Integrator shall be responsible for resolving all system integration issues identified in the interface document or identified throughout the design review process. This includes the responsibility for coordination between the Contractor and all affected suppliers and Subcontractors.
- The System Integrator shall assist in the resolution of system/subsystem interface issues during the manufacturing and testing processes.

018.4 CONTRACTOR QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

018.4.1 DOCUMENTATION AND DESIGN CONTROL (CONFIGURATION CONTROL)

The Contractor shall have an established procedure to control drawings, design modifications and change orders to ensure that specification requirements are correctly translated into the drawings and specifications that are in use for procurement, fabrication, manufacturing, or testing. This procedure shall ensure that all drawings and documents used are at the latest approved revision level.

The Contractor shall ensure that all sub-suppliers implement a similar configuration control system to ensure their drawings and documents meet the standards specified in this Specification.

018.4.2 CALIBRATION CONTROLS

The Contractor shall control all gauging, measuring, and test equipment, and ensure that it is maintained in serviceable condition and accurate calibration.

Calibration standards shall be traceable to the National Institute of Standards and Technology (NIST).

Calibration history and frequency records shall be accurately maintained and available.

Calibration dates and next calibration due dates shall be displayed on equipment where possible. Where calibration dates cannot be displayed records shall be traceable from the equipment serial number to the calibration records log.

Calibration dates and next calibration due dates for calibrated equipment used during qualification or acceptance testing must be included with the final test reports.

018.4.2 SPECIAL PROCESSES/PROCEDURES

The Contractor shall have instructions/guidelines or the established industry practices/documents for use in performance of special processes or procedures.

These shall include as a minimum, but not limited to, the following:

- Welding (see Section 017.4 and 019)
- Brazing
- Paint removal
- Painting, wrapping
- Fiberglass repair

018.4.3 PURCHASED MATERIAL

The Contractor shall provide specification data sheets for all new or modified consumable parts such as: filters, hardware, lamps, oils and lubricants, windows, etc. within 210 days of NTP. **[CDRL 18-5]**

018.4.4 FLOW CHART

The Contractor shall control manufacturing, production, and testing sequences through use of a controlled Manufacturing Plan.

This plan shall include a product work flow block diagram showing each significant operation and the related control/hold points for inspections, examinations and tests.

This flow chart shall be submitted to the Authority for review and acceptance within 30 days of NTP **[CDRL 18-6]**.

The Authority will have the right to add flow chart hold points. Hold points will not cause delay of product flow. The Contractor shall provide adequate notice to the Authority or its representative on-site when the Authority's hold points are approaching. The Authority will inspect expeditiously to avoid any negative impact to the work or the Contractor's production schedule.

This plan shall be compatible with an established Inspection Plan (see Section 0.18.5).

018.5 PROJECT INSPECTION PLAN

Within 60 days of NTP, the Contractor shall submit a Project Inspection Plan, which lists each inspection required by the Contract and the point in time of manufacturing sequence at which it will be performed. **[CDRL 18-7]**

018.6 AUTHORITY'S PARTICIPATION

The Authority shall have the right to audit and verify compliance throughout the Contract at the Contractor, Subcontractor, and supplier facilities. This right shall in no way reduce the responsibility of the Contractor to comply with all Quality Assurance requirements of this section.

Inspections by the Authority are for the purpose of verifying the Contractor's Quality Assurance Program. These inspections are not to be used as a substitute for in-process control of quality by the Contractor.

019 HULL & STRUCTURE PROTECTION

019.1 WELDING

Rigid control of welding and grounding shall be maintained. Care shall be taken that the welding polarity and ground connections of welding machines used on this vessel, other vessels in the immediate vicinity, or on the dock to which the vessel is moored shall be such as not to damage any parts of the vessel. The Contractor shall adequately protect, in all respects, the underwater part of the vessel prior to delivery. The Contractor shall ensure that all control systems and sensitive electronics have been electrically isolated as per the manufacturer's requirements prior to any welding taking place.

020 TRAINING

020.1 OPERATOR TRAINING

Thirty (30) days prior to the delivery of the first vessel, the Contractor shall submit to the Authority for approval, the name and qualifications of the person who will be the Instructor for Operator Training **[CDRL 20-1]**. The Authority shall approve this individual in advance of the vessel's delivery trip.

The Contractor-provided Operator Training Instructor shall hold a valid USCG license to operate Subchapter “T” passenger vessels and have experience with the operating characteristics of the overhauled vessel and its propulsion control system.

Fourteen (14) days prior to delivery of the vessel, the Contractor shall submit to the Authority for approval, a training plan outline and any training materials to be used. The operator’s manual may be used as training materials. Training materials shall become the property of the MBTA upon completion of the training session(s).

The Operator Training Instructor shall perform a twenty (20) hour scheduled training and instruction period both underway and at an Authority-designated location in the greater Boston Harbor area **[CDRL 20-2]**. This training period shall commence upon a mutually agreed date within seven (7) days of the delivery of the vessel. Training and instruction shall be scheduled with the Authority for weekday in-service hours. At least 15% (3 hours) of underway training time shall be in hours of darkness. Training shall be designed, so far as possible, to encompass all personnel who will be operating the vessel and shall be designed to thoroughly familiarize pilothouse personnel with all aspects of the vessel operation.

Training shall include any vessel equipment that facilitates the boarding of passengers including passengers who are using wheeled mobility devices and/or all devices meant to accommodate people with disabilities. Training shall include all aspects of ADA passenger movements from dockside marshalling areas, through bow and side gates, across the foredeck and side weather decks, and through passenger doors to the interior cabin spaces.

020.2 MAINTENANCE TRAINING

Thirty (30) days prior to the delivery of the vessel, the Contractor shall submit to the Authority for approval, the name and qualifications of the maintenance person who will be the Instructor for Maintenance Training **[CDRL 20-3]**. The Authority shall approve this individual in advance of the vessel’s delivery trip.

Fourteen (14) days prior to delivery of the vessel, the Contractor shall submit to the Authority for approval, a training plan outline and any training materials to be used. The maintenance manual may be used as training materials. Training materials shall become the property of the MBTA upon completion of the training session(s).

The Contractor-provided Maintenance Training Instructor shall be thoroughly knowledgeable concerning the overhauled vessel’s machinery and systems. The maintenance person shall perform a forty (40) hour scheduled training and instruction period both underway and at an Authority-designated facility in the greater Boston Harbor area **[CDRL 20-4]**. This training shall commence on a mutually agreed date within seven (7) days of the delivery of the vessel. Training and instruction shall be scheduled with the Authority, primarily during weekday service downtimes before or after scheduled in-service hours. Training shall be designed, so far as possible, to encompass all personnel who will be performing maintenance on the vessel and shall be designed to thoroughly familiarize those individuals with all new or modified vessel machinery and systems operations.

021 SPECIAL EQUIPMENT

021.1 PORTABLE TEST UNITS (PTUs)

Contractor shall provide two (2) laptop based PTU's, each complete with all required software, power supplies, cables and carrying case **[CDRL 21-1]**, as described in this section.

PTUs shall allow maintenance and operations personnel to diagnose failures of vessel systems and sub-systems containing embedded diagnostics that detect, diagnose and log system failures. The primary functions of the PTUs shall be to verify the proper operation of a system and, if a fault condition exists, to quickly troubleshoot and identify the failure.

This diagnostic capability shall include all processor-based systems including but not limited to the following vessel systems (if equipped):

1. Main engine
2. Propulsion control system
3. Ship service generator
4. Public address and alarm system
5. Passenger information system
6. Closed Circuit TV
7. HVAC

All portable test units shall be of a laptop, microprocessor-based type, unless otherwise approved by the Authority. Within 180 days of NTP, the Contractor shall submit for the Authority's acceptance, a listing of all systems and sub-systems for which portable test units are to be provided **[CDRL 21-1]**.

All vendor software for each system shall be fully installed and integrated into each PTU. All laptop based PTUs shall have the latest release of Microsoft Networking Windows System installed and shall have sufficient memory installed to fully support the database for storage and display of fault data, and applications software operating within the Windows operating system environment.

All PTU laptops shall be "ruggedized" for frequent use in supporting maintenance activities and shall be provided in a suitable protective case that also contains all required power supplies and interface cables with matching connectors required to interface with all systems and sub-systems.

021.2 SPECIAL TOOLS AND FIXTURES

Any special tools, jigs, fixtures, adapters, (excluding a basic mechanics set of hand tools or portable volt meter) required for normal maintenance and repair of the new or modified systems or components shall be supplied by the Contractor.

"Special tools" is defined as non-commercially available tooling – made specifically for this vessel and/or their subsystems – that are used for maintenance/repair of the vessel in accordance with recommended Contractor's practices.

At or before vessel delivery the Contractor shall provide two (2) sets of any special tools required for maintenance and/or repair of any new or modified systems or components. **[CDRL 21-3]**

Detail Drawings, suitable for manufacturing of these special tools shall be provided by the Contractor as part of the design package for the associated equipment.

022 SPARES

The Contractor shall provide pricing for spare parts per the Terms and Conditions. The Contractor shall include all requirements and prices for spares in their bid proposal. All spare parts shall be crated for storage and shipped directly to an Authority-designated storage facility in the Greater Boston Area. All spare components are to be identical to the installed components, including warranties.

023 FREEZE PROTECTION

It is the Contractor's responsibility to ensure that adequate temperatures are maintained onboard the vessel to prevent freeze-up of systems, piping, and equipment during overhaul. This shall include, but is not limited to, HVAC systems, potable water systems, flushing water systems, sanitary systems, and machinery.

Should the Contractor opt to use the vessel's heating system, and this is approved by the Authority, all costs including fuel oil, consumables, and maintenance associated with the use of the vessel's heating system shall be borne by the Contractor.

Within 30 days of NTP, the Contractor shall submit for Authority approval a freeze protection plan. **[CDRL 23-1]**

024 CORE / SCRAP CREDIT

The Authority is aware that there is a possibility certain major components and systems being replaced in this overhaul could retain a significant amount of value. Therefore, if an item is removed from the Authority's vessels which have a monetary scrap value, the Contractor is required to provide the Authority an appropriate core or scrap credit for these items. The credit shall be equivalent to the value recovered by the Contractor, less a 15% handling fee.

025 HIDDEN DAMAGE

This specification describes the base level of work to be performed on both vessels. It is understood that over the course of the program damage or deterioration may be identified that requires repairs beyond the level identified in the Technical Specification, particularly in locations that are not visible prior to removal of permanent coverings. In addition, there are many areas of the vessel where repairs will be required on an as-needed basis. To the greatest extent practical, items to be repaired as-needed will be identified prior to the vessel being turned over to the Contractor.

All work identified in the specification will be considered basic work, unless specifically noted as Hidden Damage. Any work not identified in the specification which is discovered by the Contractor shall be presented to the Authority as Hidden Damage for review and/or approval per the Commercial Terms and Conditions. The exemption or omission of an item from the specification does not absolve the Contractor of the responsibility of bringing it to the attention of the Authority for consideration as Hidden Damage.

Hidden Damage may be identified at the Pre-shipment Inspection, Receiving Inspection, or during the overhaul of the vessel. Prior to performing any Hidden Damage repairs, a quote for the labor hours and estimated parts will be provided by the Contractor to the Authority. The Authority must provide approval prior to work proceeding.

At the Authority's discretion, they may provide the Contractor with replacement components to address any Hidden Damage items.

All repairs shall be performed in accordance with standard industry best practices.

SWBS Specification Sections

The following Technical Specifications are arranged by Ship Work Breakdown Structure (SWBS) numbers in Sections:

- 100 Hull Structure
- 200 Mechanical
- 300 Electrical
- 400 Navigation, Communication and Safety Equipment
- 500 Piping, Insulation, HVAC, Fire Safety, Anchoring & Mooring
- 600 Outfitting & Markings
- 900 Tests, Inspections, Trials & Services

100. STRUCTURAL

101 STRUCTURAL REMOVALS & RELOCATIONS

Rip outs, removals, and relocations shall be accomplished as per the applicable Specifications herein. In the event the Contractor's drawings or engineering fail to designate a specific removal that is mentioned in the Specifications or is obviously necessary to complete a particular task of the Overhaul, it shall be deemed that the removal is normal and covered by good shipbuilding practice and is the responsibility of the Contractor. For example, if an unused pipe run is in interference with a new installation, good shipbuilding practice would be to remove the unused section of pipe rather than working around the interference. Removals are to be accomplished with as little damage to adjacent structure and equipment as is possible in the normal course of work.

It is incumbent upon the Contractor to ship check and to identify removals and to accomplish required removals using Good Shipbuilding Practice. The Authority will not entertain change orders for removals and/or relocations that a shipyard has failed to ship check and identify.

Removals shall be accomplished with "Good Shipbuilding Practice" as described in Section 002.2.3 and with the goal of efficiently protecting equipment that is to be reused and efficiently disposing of equipment that is to be scrapped. Contractor shall provide proper care of all equipment which is required to be relocated, or otherwise removed and reinstalled per the requirements of Section 017.3. All removed materials that are not scheduled for relocation or for shipment back to the Authority's venue shall be disposed of properly by scrapping or recycling at the Contractor's option. This includes, but is not limited to, aluminum, fiberglass, wood products, insulation, deck coverings, etc. Where applicable, core and/or scrap credits shall be provided in accordance with Section 024. All scrapping shall be in conformance of the Federal, State, and Local Regulations applicable in the Contractor's venue. The Authority cannot be held liable for the Contractor's improper disposal of any materials.

Equipment removals and relocations shall be guided by the requirements of the overhaul, by particular references within these specifications, by notations on Contractor drawings, and under the approval of the Authority. Relocations shall include the reinstallation or replacement of brackets, hardware, support structure, etc. which may be required for the utilitarian use or aesthetic presentation of equipment, furnishings, etc.

102 ASBESTOS AND LEAD PAINT

The LIGHTNING and FLYING CLOUD were both constructed in 1996 at Gladding-Hearn Shipbuilding, Somerset, MA. The vessel's construction was subsequent to the time that lead paint and asbestos were banned in ship construction. The Authority believes that there is no asbestos or lead paint on this vessel; however, the Authority has never surveyed the vessel for lead paint or asbestos. The Contractor shall confirm the foregoing through a hazmat survey, the results of which shall be provided to the Authority. **[CDRL 102-1]**

110 HULLS

110.1 HULL REPAIRS

M/V FLYING CLOUD and M/V LIGHTNING vessels have fiberglass composite catamaran hulls constructed of a cross-linked PVC foam core and Kevlar fabric. Major hull structural modifications are not anticipated; however, the Contractor shall repair all anomalies identified by survey to bring the hulls to a like-new condition. This includes, but is not limited to areas with water intrusion, damage to the core or fiberglass, and any otherwise compromised areas. A thermal infrared survey of the FLYING CLOUD was conducted in April 2020 (see Appendix B) and the anomalies noted in this report shall be repaired on this vessel. The Contractor is required to conduct a similar survey of the LIGHTNING after the vessel has arrived at the Contractor's facility (see Section 903.2) and to repair the anomalies noted in this survey.

The Contractor shall submit for Authority approval a repair plan to remove all anomalies, including water intrusion, along with all associated repair procedures. **[CDRL 110-1]** All repairs shall be submitted to the USCG for review and approval prior to commencing work. Any designated reinforced fiberglass replacement shall include the replacement of all coring, contiguous transverse frames, stiffeners, longitudinals, and bulkheads to a maximum of 12" inboard of the new insert unless a lesser dimension is specifically exempted or agreed to by the Authority and attending USCG Inspector. All through-hull fittings, valves, and petcocks shall be replaced with new. All repairs shall be accomplished to the complete satisfaction of the attending USCG Inspector and the Authority.

It is the Contractor's responsibility to maintain close communication with the Authority and USCG and to apprise both of drawing revisions and modifications if and when they develop. The Contractor is responsible to notify the Authority of any drawings, calculations, resolution of interferences, and Regulatory Body approvals, which may be associated with changes generated by Working Drawings, Sketches, and/or Vendor drawings.

If during the overhaul, additional hull repairs are necessitated beyond those indicated in these specifications, such repairs shall be submitted to the Authority for approval as hidden damage (see Section 025).

110.1.1 HULL REPAIR PRICING

The Contractor shall include in their bid a line item for fiberglass hull repairs by square foot. The Authority understands that several small repairs are more expensive per square foot than one or two large repairs and that access and interferences play a major role in pricing. The following parameters are given to help alleviate these problems and to still give the Authority and the Contractor a bench mark cost for anticipated repairs.

The Contractor shall allow for and include in their bid one hundred square feet (100 sq. ft.) of hull repairs per vessel. Contractor's bid shall assume that this will be accomplished in 5 ft. sq. increments with minimal to modest interferences. Separately,

the Contractor shall quote a price per square foot for hull repairs. Contractor will be reimbursed for the actual amount of hull repairs accomplished, with the cost to be determined by adding or subtracting from the 100 sq. ft. allowance per vessel using the price per square foot provided in the Contractor's bid. Areas with high interferences shall be quoted separately as hidden damage (See Section 025).

110.2 SHEER GUARDS

The heavy-duty aluminum sheer guards around the deck edge from centerline at the bow, along P&S sides, and around the transoms shall be inspected. Any bent or damaged metal or welds shall be repaired and brought back to an as-new condition. Rubber fendering at the bow shall be replaced in-kind, held in place by all new wire cable, turnbuckles and associated hardware suitable for the marine environment.

The aluminum fabricated water jet guards and their attachment to the hulls shall be inspected and repaired as required to bring them back to an as-new condition, including repair of any cracked welds. The waterjet guards shall be capable of protecting the jets during normal side impacts with docks or pilings.

123 TANKS

123.1 POTABLE WATER TANK

Contractor shall remove and replace the 100-gallon potable water tank with one or two new potable water tank(s) with a total 200-gallon capacity to support the conversion of the sanitary system to freshwater (see Section 528 and 533). The tank(s) shall also be relocated to allow for the installation of a second generator, per the requirements of Section 311. The location of the potable water tank(s) shall be engineered in accordance with vessel trim and heel requirements and shall meet all USCG requirements. Contractor shall be responsible for all associated modification or replacement of piping to accommodate the new size and/or location of the water tank(s).

If necessary, Contractor may propose a different shape of water tank. Contractor shall provide, for Authority review and approval, a complete potable water design package, including details of the tank(s), all piping and tank foundations. The potable water tank(s) shall be fitted with a sight gauge extending to within 6" of the tank top and bottom; a fill line with a cam lock weather deck connection; suitably sized vent line to on-deck and overboard; and suction piping to the potable water pump. The tank shall be constructed of polyethylene, composite, or aluminum, as approved by the Authority, the USCG and meeting all applicable regulations. It shall have a manhole (w/gasket) for inspection purposes. The tank(s) shall be fitted with new tank level indicators with pilothouse display and new audio/visual high-level alarms in the pilothouse.

123.2 COLLECTION AND HOLDING TANKS (CHT)

The two (2) 100-gallon sewage (CHT) tanks and all tank fittings shall be replaced in kind along with any fittings. The tanks may be constructed of polyethylene, composite, or aluminum. Vent lines and suction-off lines shall be replaced as necessary.

The pump out station shall be fitted with a standard sewage suction-off cam lock connection of 2" or per direction of the Authority. The tanks shall be installed on proper foundations. Tank fill shall be by gravity, pump out will be by shore located suction pump. The CHT tank(s) shall be fitted with new tank level indicators with pilothouse display and new audio/visual high-level alarms in the pilothouse.

123.3 FUEL OIL TANKS

The two (2) 700-gallon aluminum fuel oil tanks are located on foundations, one in each fuel oil void P&S. The Fuel Oil tanks shall be replaced in-kind, constructed of 5083 x 0.25" aluminum plate with 5086 H112 aluminum extrusions, or other Authority approved material. The new fuel tanks shall be of a size that fits in the existing footprint of the original tanks.

New fuel oil tanks shall be of the same configuration of the tanks being removed, with suction, return, fill and vent lines locations being arranged in kind. The fuel oil tanks shall also have an external liquid level sight glass mounted on the front of the tank with upper and lower isolation valves. Tank drains shall be closed off with a plug, properly supported valve or other Authority-approved design that is not susceptible to cracking from vessel vibrations.

All welding in fuel oil tanks and other liquid tanks shall be continuous on all boundaries – interior and exterior. Direct attachments of fittings to oil tight structure shall be by welding only. It is the Contractor's responsibility to ensure the quality of tank welding and meet USCG requirements.

To facilitate the removal and installation of the fuel tanks, a temporary access point will be required to be cut into each hull, approximately 5 feet by 7 feet in size. The Contractor shall design and engineer a plan to cut out and replace the removed section of hull and shall be approved by the Authority prior to performing.

See Section 261 for additional Fuel Oil System requirements.

130 DECKING

Contractor shall remove all floor coverings and coatings (per the requirements of Sections 631 and 634) and inspect all decking for soft spots, cracks, holes, corrosion, detachment from supporting structures, and any other conditions that compromise the strength and longevity of the floor. The Contractor shall notify the Authority of any such conditions identified and shall submit a repair plan and procedures for Authority approval.

Weather deck and Main Deck inserts shall be continuously welded and proved watertight to the approval of the attending USCG Inspector and Authority. Fit-up shall receive attending USCG Inspector's and Authority approval and be in accordance with Good Shipbuilding Practices and

Standards. Care shall be taken to avoid stress concentrations due to hard spots, notches, discontinuity or structure, or locked-in stresses due to improper welding sequence. All structure where exposed to weather shall be seal welded continuous.

Contractor shall perform non-destructive testing (NDT), as required, by air/suction box and soap, “dye-penetrant,” or other approved method mutually agreeable to the Authority, Contractor, and attending USCG Inspector. The attending USCG Inspector may require weld NDT testing of Main Deck inserts, etc. Locations of required points shall be at the discretion of the Authority and attending USCG Inspector.

After repair, and successful testing, all decking shall be recoated and/or re-covered per the requirements of Sections 631 and 634, and OEM application instructions.

130.1 DECKING REPAIR PRICING

The Contractor shall include in their bid a line item for aluminum decking replacement inserts. The Authority understands that several small inserts is more expense per square foot than one or two large inserts and that interferences play a major role in pricing. The following parameters are given to help alleviate these problems and to still give the Authority and the Contractor a bench mark cost for anticipated replacements.

The Contractor shall allow for and include in their bid five hundred square feet (500 sq. ft.) per vessel of deck replacement with 5083-H116 aluminum plate. Contractor's bid shall assume that this will be accomplished in 25 ft. sq. increments with minimal to modest interferences. Separately, the Contractor shall quote a price per square foot for plate replacement. Contractor will be reimbursed for the actual amount of deck replacement provided, with the cost to be determined by adding or subtracting from the 500 sq. ft. allowance per vessel using the price per square foot provided in the Contractor's bid. Areas with high interferences shall be quoted separately as hidden damage (See Section 025).

130.2 MACHINERY SPACE & HULL VOID OVERHEAD REPAIR

The jet rooms and the aft portion of the engine rooms have been prone to deterioration of the overheads from water buildup in the structural grid positioned on top of the hulls in those areas. This was noted in prior USCG inspections. Temporary repairs were made previously, however a more permanent repair and solution to the water accumulation is needed.

The Contractor shall evaluate these areas and shall design and implement a modification to prevent water accumulation and the associated deterioration. All modifications shall be approved by the Authority and the USCG and shall be implemented to the satisfaction of the USCG OCMI. Contractor shall repair any damaged portion of the engine and jet rooms, and other voids to bring them to a like-new condition.

Insulation in the overheads of the jet and engine rooms have been removed temporarily to allow for easier monitoring of the overhead condition. After completion and inspection of all modifications and repairs, the Contractor shall provide and install new insulation.

The machinery spaces and other hull voids shall also be cleaned, as required by Section 650, and repainted per Section 631.4.

131 BRIDGE PLATES (TRANSITION PLATES) AND HOLDERS

The Contractor shall provide a portable, lightweight aluminum bridge plate for each vessel (See sample design in **Appendix H** as a guide). The bridge plates shall be designed to fit from the vessel bow to the dock structure providing a continuous surface for walking and for the operation of wheel chairs between the vessel deck and the dock surface.

The bridge plates shall comply with the PVAG requirements of Sections V405.4 & V302.1 (Deck Surfaces); V405.5; and V405.9 (Edge Protection).

The bridge plates shall weigh no more than 25 pounds.

A bridge plate stowage rack shall be provided and located on the inside face of foredeck bulwarks or other foredeck location to the approval of the Authority. Bridge plate and storage rack design and location shall be submitted to the Authority for approval [**CDRL 130-1**]. The stowage rack shall be fitted with a securing arrangement that prevents rattles but permits the plate to be easily removed and replaced.

150 SUPERSTRUCTURE

Contractor shall removal interior liners and insulation (see Sections 508.1 and 645.2.5). Contractor shall remove all paint from the superstructure's exterior and from all painted areas of the superstructure's interior. Contractor shall inspect and repair any damaged areas of the superstructure, including its supporting structure and the corrugated splash guard beneath the main deck.

New aluminum for any refitted or new construction portions of the superstructure, deckhouses and miscellaneous structures shall be 5083-H116 aluminum. Repaired areas shall not be visually different from the surrounding structure after coating of the superstructure; this includes flatness and warping of the aluminum after welding.

Any new structural bulkheads shall be properly stiffened to minimize distortion. All welding shall be by American Welding Society (AWS) certified welders properly qualified for the welds which they are to perform, or USCG approved automatic equipment in accordance with the requirements of the USCG. Proper welding techniques and sequence shall be used to limit stresses and distortions. Tack welding shall be kept to a minimum and shall not be capable of limiting free movement of structure during finish welding.

All structure where exposed to weather shall be seal welded continuous. Replacement superstructure sideshell "curtain" plate, if needed, shall be water hose tested to the approval of the Authority and the attending USCG Inspector prior to coating applications.

All exposed aluminum surfaces shall be cleaned of corrosion. Contractor shall repaint the previously painted surfaces per the Authority approved color schemes (see Section 631.5) and the

paint manufacturer's directions. Paint systems shall be submitted to the Authority for review and approval prior to application.

The corrugated roof on Lightning's partially enclosed upper deck passenger seating area shall also be removed and replaced with an aluminum roof similar to Flying Cloud.

Contractor shall also provide and install adequate Inflatable Buoyant Apparatus (IBAs) per the requirements of Section 436.2.

150.1 SUPERSTRUCTURE TO HULL ATTACHMENT

The superstructure is an aluminum unit bolted to the hulls. The attachment of the main deck to the hulls shall be inspected, and all rusted or otherwise compromised hardware shall be replaced with new stainless steel hardware meeting USCG requirements, suitable for the marine environment and properly isolated from the aluminum superstructure. Watertight hull integrity shall be examined and repaired as required to ensure watertightness.

150.2 CORRUGATED SPLASH GUARD

The corrugated aluminum splash guard below the superstructure shall be replaced with new. Contractor shall propose a modification for Authority approval to facilitate drainage and inspection of the splash guard and the superstructure's underside.

151 EQUIPMENT FOUNDATIONS

The Contractor shall provide and install adequate foundations for all added or relocated equipment, and for any equipment modifications, as required. Foundations shall be arranged to permit ready inspection and maintenance access to all parts of the equipment, which they support.

Specifically, the Contractor shall provide and install new or modified foundations for the new and updated generator sets, main distribution switchboard, HVAC compressor units, electrical panels, control panels, and all other modified or added machinery and equipment. Other foundations that are to be retained shall be cleaned, inspected, and if necessary, repaired.

151.1 MAIN ENGINE FOUNDATIONS & VIBRATION MOUNTS

Engine foundations shall be cleaned, inspected, and returned to an as-new condition, repainted as part of the engine room painting (see Section 631). If repairs are required, Contractor shall notify the Authority as hidden damage and provide a repair plan for Authority approval.

Contractor shall replace the engine's vibration mounts with new OEM components or approved equal.

151.2 SSDG FOUNDATIONS

The Contractor shall accomplish required modifications to the existing SSDG foundation located in the starboard hull Engine Room to accommodate the replacement of the existing generator with new, per the requirements of Section 311.

The Contractor shall fabricate and install a new generator foundation for the additional generator to be located in the port hull engine room in way of the potable water tank (to be relocated). This work will require removals and modifications to the existing deck plating and deck plating structure. Deck plating shall be replaced to adequately provide a safe walking surface in way of the new foundation to the approval of the Authority.

Contractor shall provide and install new vibration mounts suitable for the new SSDGs. These mounts shall be included in the Contractor's design package for the SSDGs.

151.3 COATINGS:

Existing coatings shall be removed and reapplied per the manufacturer's application instructions. New foundations shall receive the same finish as the existing foundations.

155 WATER JET INTAKE TUNNELS

The water jet intake tunnels shall be inspected. If repairs are required, the Contractor shall notify the Authority, and the repairs shall be completed as hidden damage per an Authority and USCG approved plan. They shall be repainted as part of the hull painting per Section 631.

166 ENGINE REMOVAL PATCH

Watertight, bolted-plates are provided and installed in the main deck overhead of each engine room for engine removal. The bolted plates are fitted with gaskets and bolted in. The underside of the hatch shall be cleaned of any salt or mineral deposits, and the perforated metal sheathing shall be straightened or replaced; and new insulation shall be installed to provide sound and vibration dampening to increase passenger comfort. Contractor shall replace the hatch gaskets and securing hardware with new. Contractor shall test and ensure the watertightness of the engine removal patch.

167 WATERTIGHT HATCHES & SCUTTLES

The Contractor shall ensure the integrity of all existing and new deck manholes, scuttles, access plates and hatches, and shall verify water tightness, where applicable. The Contractor shall replace the hatches in-kind, or recondition to a like-new state. If hatches are reconditioned, Contractor shall at a minimum: clean, inspect, test and lubricate all hatch mechanisms, clean gasket channels and knife edges of all rust and debris, and replace gaskets in-kind with new prior to final close up.

Two portable safety gratings of fiberglass or aluminum shall be provided to set into open hatches when personnel are working within a space with the hatch cover removed.

167.1 NEW ENGINE ROOM EMERGENCY ESCAPE HATCH

A new, emergency escape hatch, and any associated ladders or other equipment, shall be added in each engine room, aft of the main engine, to provide an emergency escape from each engine room P&S. The new cast aluminum watertight deck hatches shall be Bomar C424, Freeman 2400 series, or approved equal, with interior quick acting escape handle.

The escape hatch and associated equipment shall be compliant with the requirements of the USCG – in particular 46 CFR 177.500 and shall be approved by the Authority and USCG prior to installation.

It is anticipated that the hatch would need to be flush mounted, as it would be located in the aft P&S boarding areas between the engine hatch and the exterior of the heads. All appropriate signage shall be provided to ensure that the hatches are kept free of obstructions.

To accommodate this new hatch, modifications will also need to be made to the port and starboard side loading gates, per Section 623.3.2.

168 WEATHERTIGHT DOORS

The Contractor shall remove, and replace with new the main deck and upper deck weather-tight doors as described in Section 611:

- Two (2) pilothouse doors – 1 port, 1 starboard
- Two (2) main deck side loading, sliding doors – 1 port, 1 starboard
- Two (2) main deck bow loading, hinged doors – 1 port, 1 starboard

169 AFT ESCAPE DOOR/HATCH

Contractor shall remove and replace the escape door in the aft bulkhead of the commissary as detailed in Section 611. Replacement door shall be weathertight with hinged construction to allow for easy opening.

171 MASTS

The Contractor shall provide and install appropriate masts and foundations to mount any newly installed equipment. Where existing masts and foundations are reused, they shall be inspected and repaired if required for structural integrity and waterproofing of any roof penetrations.

Contractor shall modify the existing mast to incorporate a yardarm, rigging, and hardware fitted suitable for showing Contractor-supplied NUC (Not Under Command) day shapes and fueling pennant.

The mast located on centerline upper deck aft for flying US Ensign shall be cleaned of excess or damaged welds, where present and rewelded. Rigging, hardware and US Ensign shall be replaced with new.

200. MECHANICAL

233 PROPULSION – DIESEL ENGINES

The existing Tier II MTU 2000 M70 main propulsion diesel engines and the Authority's one spare shall be overhauled to no less than EPA Tier II by an MTU certified shop, per the specification provided in Appendix F. The Contractor shall maintain communication with the engine overhauler throughout the engine overhaul process. The Authority shall be copied on all electronic and written communication between the Contractor and engine overhauler. It is critical that the overhauled main propulsion engines suffer no reduction in performance after overhaul.

Each engine shall undergo a dynamometer load test to ensure that the rated load is obtained over the full operating range. At the Authority's discretion, the Authority shall be allowed to witness the testing of one or more overhauled engines at the overhauler's facility.

The Contractor shall degrease, clean and dry the engine room bilges after engines are removed, and ensure the bilges are clean, painted (per Section 631.4, item 6), and free of all debris prior to delivery of the overhauled vessels to the Authority. In conjunction with the main engine overhauls, all flexible hoses, fittings, and strainers shall be replaced in-kind and to the specifications of the CFRs and to the approval of the MTU Tech Rep and attending USCG Inspector.

After reinstallation of the overhauled engines, the Contractor shall be responsible for aligning all drive line components to the Manufacturer's requirements. Final alignment shall take place after floating the vessel and prior to engine start-up and Dock Trials. Alignment procedures shall be presented to the Authority and the engine and waterjet manufacturer's technical representatives prior to the completion of shaft line component installations. Alignment shall be performed in the presence of the main engine and waterjet manufacturer's technical representatives (MTU and MJP) and shall be approved by the technical representatives. The Authority shall be copied on all electronic and written communication between the Contractor and USCG concerning the reinstallation of the propulsion system.

The Contractor shall provide the Authority with all alignment readings after all propulsion equipment has been installed via a Condition Found Report. The Contractor shall be responsible for providing the required report within five (5) days of the inspection.

233.1 ENGINE MONITORING SYSTEM

The Contractor shall supply, integrate and install an engine monitoring system on the newly overhauled main propulsion engines, GP Link or Authority approve equal. The engine monitoring system shall provide remote data collection via Wi-Fi and local data download. Engine monitoring data shall include but not be limited to all critical engine parameters including oil pressure, coolant temperature and engine hours and be visible on an LCD pilothouse display panel.

Contractor shall be responsible for all billing, service plans and/or re-occurring costs associated with the engine monitoring system from the initial installation and activation through the end of the vessel's warranty. All billing, service plans and/or re-occurring cost

associated with engine monitoring system after expiration of the vessel's warranty shall be directed to the Authority at:

Deputy Director of Finance – Railroad Operations & Water Transportation
Massachusetts Bay Transportation Authority
1 South Station, 2nd Floor
Boston, MA. 02110

241 REDUCTION GEARS

The Contractor shall remove the P&S reduction gears (ZF 2050) including, but not limited to, gear shafts, couplings, and seals, as appropriate from each vessel. The removed ZF reduction gears, as well as one (1) spare gear supplied by the Authority, totaling five (5) reduction gear sets, shall be shipped to an authorized ZF repair facility for overhaul. The gears shall receive a complete inspection and overhaul as specified by ZF factory recommendations and as detailed in the ZF Maintenance Schedule sheet. This shall include, but may not be limited to, replacement of the drive coupling filters, valves, seals, and bearings; test/rebuild or replacement of the gear oil cooler; removal and inspection of the control unit; replacement of input and output seals.

All items identified by the certified ZF technician as damaged or defective, that are not listed on the OEM overhaul parts list, shall be replaced during the overhaul and covered under Hidden Damage.

Upon completion of the overhaul, the gears shall be re-installed in the vessel by the Contractor under the direction of a ZF technical representative. The Contractor shall be responsible for all costs associated with ZF's services and expenses, transportation of the gears, and parts and labor for the overhauls. The additional gear set supplied by the Authority shall be crated and properly prepared for long term storage per OEM recommendations and shall be delivered to an Authority-approved location in the Greater Boston area to be inventoried as a useable spare.

As described in Section 233, the Contractor shall be responsible to ensure the propulsion shafting is in alignment with the reduction gears and the main engines at the time of reinstallation.

242 COUPLINGS, SHAFTING, SEALS

The Contractor shall remove all shafting and coupling components between, and including the main engine output shaft couplings and the jet drive input shaft couplings. Shafting and couplings shall be replaced in-kind with new. Bolts, washers, seals and bearings shall be replaced with new and the shaft line shall be re-assembled and aligned per Section 233. Final alignment shall be with the vessel waterborne.

246 WATER JETS

The Contractor shall remove P&S MJP jets and components and shall contract an MJP certified shop to rebuild same according to the manufacturer's specifications and recommendations as well as the requirements of the waterjet overhaul specification provided in Appendix G.

The waterjets and associated equipment will be integrated with a new maneuvering and control system described in Section 568.

Final alignment shall take place after floating the vessel and prior to engine start-up and Dock Trials. Alignment procedures shall be presented to the Authority and the waterjet manufacturer's Technical Representative prior to the completion of shaft line component installations.

252 ENGINE/PROPULSION CONTROL SYSTEM

The Contractor shall remove all old electronic propulsion control system equipment and provide and install a new electronic propulsion control system in conformance with the engineering requirements of the engine and water jet manufacturers. The control system shall be as simple and straight forward as possible.

The electronic control system shall be provided and installed at the Pilothouse center console for control of the main engine governors, reverse/reduction gears. The system shall be provided with redundant power supplies and automatic power transfer. A back-up control system shall be incorporated. A failure alarm system shall be provided for the control and hydraulic system functions.

259 EXHAUST SYSTEMS

The Contractor shall remove the old and provide and install a new exhaust system – DeAngelo Marine Exhaust, Marine Exhaust Systems or equivalent, for the main engines and generators, including the additional generator to be installed in the port hull. Exhaust systems shall include, but not be limited to, exhaust hoses, muffler, manifolds, silencers, spray rings, and all removable flex connectors, expansion joints, hangers, and associated hardware to provide complete and operational exhaust systems. Mixing tubes connected to the engines shall be retained, inspected, repaired as required, and reinstalled. Hot piping shall be fitted with high-temperature, approved, fiberglass blanket insulation. The new exhaust system shall meet OEM requirements and follow the existing exhaust system routing with minimal change to the system arrangement. The system shall be designed to withstand the normal forces, vibration, and environmental conditions on the vessel in normal service for the remainder of its service life.

The exhaust system design shall be compliant with all USCG requirements shall be submitted to the Authority for review and approval.

261 FUEL OIL SYSTEM

The Contractor shall plan, design and engineer the removal of old and installation of two (2) new in-kind replacement fuel oil tanks on each vessel per the requirements of Section 123.3. The Fuel Oil tanks shall be fitted with automatic tank level indicators (TLIs) with a new digital pilothouse display and audio/visual high- and low-level alarms. A new high-level alarm shall also be located at the main deck fueling station in accordance with the requirements of 46 CFR and the local OCMI.

The Contractor shall also replace with new or install new the following fuel oil system components:

1. Fuel oil suction lines and valves.
2. Fuel oil return lines and valves.
3. Double walled fuel lines with leak detection system tied into the alarm system.

All fuel oil piping components shall be metallic. All piping, valves, fittings, and connections shall conform to USCG requirements. Fuel oil supply and return lines and valves shall be CRES. The fuel oil manual remote actuators shall be cleaned, inspected and tested for proper operation. The Contractor shall replace all flexible hoses and fittings in-kind with new, and in accordance with the specifications of the CFR and approval of the attending USCG Inspector.

The Contractor shall replace the P&S fuel oil tank vent piping in-kind with new. Fuel tank vents shall be fitted with new audible whistle alarms.

The main engine and ship's service generator fuel oil supply lines shall have new engine manufacturer-approved primary and secondary filters installed. The primary filters shall be duplex, marine service, heavy duty, high capacity, water separator and particulate filters that meet the respective engine manufacturer's specifications. The secondary filters shall meet the respective engine manufacturer's specifications. All filters installed shall have local, New England parts availability.

Mechanical reach rods on fuel shut off valves shall be inspected, cleaned, greased and exercised for proper function and be in compliance with USCG requirements.

The Contractor shall remove the existing fuel oil pumps and replace with new, of the same size and rating, and piping arrangement. New fuel oil pumps shall be specifically approved for commercial fuel oil system service.

Contractor shall make modifications, as necessary, to properly connect the fuel oil system to the replacement SSDG in the starboard hull and the new SSDG in the port hull. To the extent possible, the port SSDG fuel oil piping, components and connections shall replicate those of the starboard SSDG.

The resulting main engine and generator fuel oil systems shall be fully operational and shall be in conformance with the CFR, and to the approval of the Authority and attending USCG Inspector.

262 DIRTY OIL SYSTEM

The main propulsion engines shall be modified during the overhaul to include a dirty oil suction-off arrangement in compliance with OEM recommendations and USCG regulations. The overhauled engine shall include a ball valve at the sump connection; a flexible hose (USCG approved for lube oil service) leading up to a convenient location above the engine room floor plates; and a ball valve, quick-connect cam-lock fitting, and cap or plug at the discharge end. The

discharge end and fittings shall be securely attached to structure and arranged for ease of connection to a shore side suction-off hose.

The ship service generators and overhauled reverse/reduction gears shall have a ball valve fitted at the oil sump connection. The arrangement shall be so that a suitably sized container can be conveniently positioned to drain off dirty oil.

All lube oil system equipment and arrangement shall be to the approval of the engine or gear manufacturer, the USCG, and the Authority.

300. ELECTRICAL

301 GENERAL

Electrical installations and modifications shall be performed in compliance with the requirements of 46 CFR subchapter J. All recommendations of the Institute of Electrical and Electronics Engineers Standard No. 45 apply except where specifically prohibited by 46 CFR Subchapter "J". In such cases, the CFR regulations take precedence.

Installations of electrical equipment and wiring necessitated by work covered in other portions of these Specifications shall be provided by the contractor whether or not specifically called for in the Electrical portion of these Specifications. The Contractor shall make minor alterations and wiring modifications as a part of the Contract deliverables.

Software for systems that are microprocessor based and developed specifically for this contract shall be capable of being escrowed for the ten-year support requirement.

301.1 RIPOUTS

Where removals and rip outs are called for, cable will be pulled back to the first junction box and disconnected.

301.2 MATERIALS

All newly installed equipment, wiring, connections and associated parts shall be designed for satisfactory operation under the conditions of moisture and vibration prevailing in shipboard service and shall be treated to provide protection against corrosion, moisture, salt, and other destructive agents to which the vessel may be exposed under adverse climatic conditions during its normal service lifetime.

All wiring used in any electrical component installation shall be UL marine grade and tinned. Bulkhead and deck penetrations shall be incorporated with watertight strain relief fittings and multi-cable transits. Minimum conductor insulation thicknesses shall be as required by USCG, ABS and IEEE where applicable.

301.3 ARRANGEMENTS

All added or modified electrical equipment shall be designed and located to be readily accessible for repairs and removal. Equipment mounted on or adjacent to bulkheads shall be accessible for servicing and adjustment without dismantling panels, etc. Equipment shall be located to reduce to a minimum any likelihood that it could be damaged by leaking fluids or excessive heat and shall be to the approval of the Authority.

301.4 NAMEPLATES AND MARKINGS

New nameplates shall be provided and installed to identify all equipment, whether previously installed, or newly installed by the Contractor. Sufficient markings shall be installed on all electrical equipment and wiring to enable service personnel to form a rapid appraisal for repair

and servicing. Special precautions shall be clearly noted as required. All electrical panel identification cards shall be updated to reflect Contract modifications. Blank nameplates shall be provided for spare feeder switches and circuit breakers.

Switchboards and distribution panel buses shall be stamped in a readily visible location with polarity or phase designations. Multi-conductor cables having more than four conductors shall be marked with circuit letter and number.

301.5 NEW OR RELOCATED TERMINATIONS

Electrical equipment which requires external wiring shall be provided with suitable terminal boards or blocks equipped with solderless lugs to which the Contractor shall make all necessary connections. Exceptions follow:

- All motors, except waterproof, shall be provided with drip-proof terminal boxes and shall have terminal leads suitably secured to the motor frame. The ends of the leads shall be fitted with approved connectors suitable for use with the terminal lugs of incoming cables. Circuit breaker and motor control main power terminals may be equipped with lugs for direct connection of ship cables.
- Terminal boards, strips, blocks, etc. shall be of self-extinguishing phenolic or non-hygroscopic insulating materials and shall be equipped with barriers between terminals. Terminal lugs shall be solderless of the clamp or compression type, except that terminal lugs for #16AWG or smaller wiring shall be of the crimped type. The lugs may either be removable from the conductor or they may be permanently fastened to the conductor by an approved mechanical squeeze grip method.
- Terminal lugs for #8AWG and larger conductors shall be of the two-hole type to prevent turning. For smaller conductors or where it is impractical to use two fastening bolts due to space limitations, a locking feature may be substituted.
- The conductivity of connections shall not be less than the conductivity of connected cable. All bolts, screws, nuts and washers shall be made of corrosion resistant metal of adequate size for their function. Lock washers or a similar means of preventing loosening of connections shall be employed throughout.

302 ELECTRICAL ANALYSIS

It shall be the responsibility of the Contractor to generate an electrical load analysis. Each newly installed generator shall be sized properly for the existing electrical loads after overhaul plus a 15% reserve capacity allowance for potential electrical load growth, or the reserve requirement per CFR, whichever is greater. Demand factors and maximum permissible voltage drops shall be as required by regulatory body requirements and published standards.

Contractor shall check all circuits on the vessels and shall develop:

- 120/240V AC Electrical Load Analysis

- 120/240V AC One Line Diagram
- 24V DC Electrical Load Analysis
- 24V DC One Line Diagram

These documents shall account for all existing electrical loads and cables that will be retained, as well as any new or modified ones. Contractor shall be responsible for ensuring that the SSDGs are capable of powering the necessary loads. Contractor shall ensure that the electrical load of all items powered when the vessel is on shore power shall be within the limits of the existing shore power connection (see Section 321.1). Where necessary, the Contractor shall propose any necessary modifications to the existing system to accommodate the overhauled vessel's electrical needs.

311 SHIP'S SERVICE DIESEL GENERATORS

The vessels are each equipped with a 38kW Northern Lights M944T resiliently mounted ship's service diesel generator (SSDG) which comply with applicable EPA Tier II emission standards. The existing generator in each vessel shall be replaced with a new genset meeting the electrical needs identified in the Contractor's electrical load analysis per Section 302 and rated to meet the applicable EPA emissions standards or better. The Contractor shall also provide, plan, design and install a second resiliently mounted, SSDG of the same make and model into the port hull's engine room. The gensets shall comply with applicable EPA emission standards for newly manufactured marine engines of their class. Contractor's installations shall also meet ABS or DNV standards, including but not limited to the use of double walled fuel lines, metal fuel pump system, spray shield and insulation blankets.

Accommodations for preventative maintenance shall be built into the design and shall be demonstrated as part of the maintainability demonstration (see **Section 0.11.6**). The SSDG engines shall be supported by the engine manufacturer's certified technician(s) located in southeastern New England within a four-hour surface travel of the Boston Harbor Area.

If suitable for this application, installation of the John Deere model 4045TFM85 used on the Authority's other vessels would be beneficial for the standardization of spare parts; however, it is the Contractor's responsibility to provide and install a generator that is well matched to this application.

The generator sets shall be supplied with the following:

1. Cooling by heat exchanger system
2. Wet exhaust
3. Block heater
4. Starter and Alternator

5. Anti-vibration mounts
6. Lube oil filter
7. Engine gauge, alarm and control panel. Start/stop shall be located at each generator and remote panel. Engine gauges, alarms and start/stop control shall be in the pilothouse and at the transfer panel.
8. USCG Approved shutdowns and safety features including overspeed, low oil pressure, and high temperature shutdowns
9. Drip tray
10. Remote, pilothouse alarms

313 BATTERIES & CHARGERS

The Contractor shall remove all batteries and chargers and dispose of them in compliance with all applicable regulations. Batteries and chargers, and associated cables shall be replaced with new per the following subsections. All ancillary wiring and components shall be tested

313.1 EMERGENCY SERVICE 24V DC

The Contractor shall replace the 24V DC Emergency Service batteries with new in compliance with 46 CFR Part 112.55 Storage Battery Installation. The Contractor shall provide properly sized, AGM-type, deep cycle, batteries to continue to meet the applicable requirements of 46 CFR 112.55. These battery banks shall be charged by new 24V AGM battery chargers to be provided and installed by the Contractor, appropriately sized and set for the batteries selected and fed from a 120V AC circuit.

The emergency 24VDC service shall continue to support all applicable loads required by 46 CFR 112.15-1 Temporary Emergency Loads for Subchapter T vessels, including:

- (a) Navigation lights
- (b) Machinery space lighting
- (c) General Emergency lighting
- (d) Exit signs
- (e) - Not applicable -
- (f) Work spaces
- (g) Survival craft stations
- (h) - Not applicable -
- (i) - Not applicable -
- (j) Emergency communications
- (k) - Not applicable -
- (l) - Not applicable -
- (m) - Not applicable -
- (n) - Not applicable -
- (o) Ship's whistle

- (p) - Not applicable -
- (q) - Not applicable -
- (r) -Not applicable -

Battery size and count shall be determined by the Contractor's DC electrical load analysis. The battery bank shall be sized properly for the DC electrical loads after overhaul and for a reserve capacity allowance for potential DC electrical load growth.

313.2 ANTICIPATED 24V DC EMERGENCY LOADS

1. Main engine control power
2. Pilothouse DC panel
3. Propulsion control and monitoring systems
4. Ship's service generator control power
5. PA System
6. Emergency Lighting per 46 CFR 183.432 (4)

313.3 BATTERY CHARGERS

All battery chargers shall be replaced in-kind with new.

313.4 MAIN ENGINE STARTING BATTERIES

The Contractor shall be responsible for removing and disposing of the main engine starting batteries from the vessels in compliance with all applicable regulations. The Contractor shall provide and install a new, dedicated, commercial grade, deep cycle, marine service, AGM main engine starting battery bank in each engine room. These battery banks shall be sized as per the engine manufacturer's recommendations and shall be charged by AGM battery chargers fed from a 120V AC circuit, appropriately set for the batteries selected. The starting voltage shall remain 24VDC, per the engine manufacturer's recommendation.

All cables and connectors associated with the main engine starting batteries and charging system shall be replaced with new. The new battery cable installation shall be presented for approval during the design review process.

313.5 GENERATOR STARTING BATTERIES

The Contractor shall be responsible for removing and disposing of the generator starting batteries from the vessels in compliance with all applicable regulations. The Contractor shall provide and install a dedicated, commercial grade, deep cycle, marine service, AGM generator starting battery bank for each generator. They shall be sized as per the engine manufacturer's recommendations and charged by AGM battery chargers fed from a 120V AC circuit,

appropriately sized and set for the batteries selected. The selection of starting voltage (12VDC or 24VDC) shall be determined by the engine manufacturer's recommendation.

All cables and connectors associated with the generator starting batteries and charging system shall be replaced with new. The new battery cable installation shall be presented for approval during the design review process.

321 POWER DISTRIBUTION

321.1 SHORE POWER

The available shore power at the MBTA's Hingham overnight "lay-up" facility is 100 Amp, 120V/208V, single phase, however this system is scheduled to be updated to a 100 Amp, 120V/240V, single phase system. Shore power shall be used to supply the main switchboard "lay-up" circuit breaker during mid-day and overnight layover, therefore additional information about the available shore power at the MBTA facilities will be provided during the Conceptual Design Review (CDR) phase required in section 007.3.1 of this specification.

321.2 SSDG INTEGRATION

The Contractor shall provide all modifications required to integrate the additional port SSDG into the power distribution system, as well as any modifications to accommodate the replacement starboard SSDG.

321.3 POWER SOURCE TRANSFER AND LOAD SHEDDING

The new main switchboards required per Section 324 shall be capable of distinguishing and transferring between shore power and generator inputs. The system shall prevent shore power and generator power from being energized at the same time. All USCG requirements for safety, indicators, etc., shall be adhered to. When the vessel is connected to shore power and the shore power transfer switch is placed in the shore power position, the electrical system shall automatically load shed selected circuits which are not required to be fed from shore power during layup. Items to be shed shall be proposed by the Contractor based on their load analysis, and shall be reviewed and approved by the Authority, with modifications as required.

Distribution of shore power to the vessel systems shall be designed to accommodate, at a minimum:

1. Battery Chargers
2. Heaters: lay-up heaters shall be powered to maintain engine rooms, jet rooms, tank voids, pilot house and interior passenger spaces at a temperature of at least 50°F with an outside ambient temperature of -10° F.
 - a. Pilothouse: Shore power heating of the pilot house shall be provided by an electric heater with air-circulating blower.
 - b. Passenger Areas: shore power heating of the passenger areas shall be via

electric bulkhead or overhead heaters.

3. Main Engines: Shore power heating of the main engines shall be by an electrical heating system external to the engine blocks. Kim Hot Starts, or equal, block heaters shall be capable of maintaining engine block temperatures in the range of 80F to 120F.
4. Generator Engines: Shore power heating of the genset engines shall be by an electrical heating system external to the engine block. Kim Hot Starts, or equal, block heaters shall be capable of maintaining engine block temperatures in the range of 80F to 120F.
5. Thermal Protection of Water Systems: All aspects of plumbing shall be arranged so that when vessel is on shore power in sub-freezing weather, no damage shall occur to lines or fixtures. Any water piping exposed to the ambient environment shall be protected with thermostatically controlled heat tape, Thermon Heat Trace system, or equal.
6. Lighting: Sufficient lights shall be powered by shore power to allow for emergency lighting, daily cleaning, and maintenance activities.
7. Electrical receptacles: Electrical receptacles shall be powered when the vessel is on shore power.

321.4 GROUNDING SYSTEM

The Contractor shall replace the vessel's grounding system cables and connection points. (If not possible to replace "through-hull" connection points – grind clean as a minimum). External ground plates on each hull shall be cleaned, refurbished, and put into new condition.

321.5 NEW AND MODIFIED CABLE AND WIREWAYS

321.5.1 CABLE RUNS

Cables shall be run as directly as practicable consistent with adequate ventilation of cableways and with due care in the avoidance of hazardous or undesirable locations such as areas of excessive heat or moisture; areas adjacent to magnetic compasses and critical electronic equipment; areas of exposure to mechanical damage; locations creating interferences with machinery maintenance and removal; inflammable material storage areas; inaccessible spaces. Cables shall be installed as required by IEEE Std. 45-2002, Sections 25 through 28.

Cables shall not be installed adjacent to piping, etc. which may create moisture from leakage or condensation. If proximity to such piping, etc. is unavoidable, suitable shielding shall be installed.

Cables shall not be installed in bilges unless no other run is practicable. New or relocated junction box locations shall be approved by the Authority. All cables shall

be continuous between outlet boxes, connection boxes, switchboards, panel boards, etc.

Details of cable and wireway installations and methods of mounting electrical equipment shall conform to generally accepted marine practices.

321.5.2 WIREWAYS AND SUPPORTS

Wireways and cables shall be arranged to provide cable segregation as required by the specific cable runs and in accordance with CFR and IEEE standards. Cables shall not be painted. Cables grouped in a single hanger should be limited to double banking.

Supports shall be spaced no more than 18" apart where vertical and 14" where horizontal. Cables shall be securely strapped to every second hanger on horizontal runs and every hanger on vertical runs.

Single cable runs shall be supported by aluminum metal clips attached to the deck or bulkhead by means of aluminum welded pads or studs.

Stud welded open hook type cable hangers are also acceptable for supporting up to four 3/4" diameter cables. Approved banding methods and/or prefabricated cable supports may also be used. Careful attention shall be given to installation of cables in exterior locations where cable runs shall be restricted to single layers and bracketed away from surfaces to avoid the accumulation of moisture and to allow for periodic maintenance.

Use of single automatic end welded stud, cup washer, aluminum spacers and/or aluminum adapter plates for mounting small electrical equipment will also be acceptable. Attachments to watertight bulkheads or decks shall be by welded studs. Through bolting is not allowed.

321.5.3 PENETRATIONS

Openings in decks or platforms for cable penetrations, which do not require stuffing tubes or kick pipe protection shall have a suitable bushing of a type that will permit drawing at the cable without damage.

Where cables pass through watertight or weathertight bulkheads, the Contractor shall provide a tight penetration system. Where cables enter waterproof motors, watertight control equipment or tops and sides of drip-proof cabinets, approved watertight stuffing tubes or terminals shall be installed.

321.5.4 ENCLOSURES & PROTECTION

All wireways which are subject to physical damage shall be suitably protected against mechanical injury.

321.6 RETAINED CABLE

Contractor shall physically inspect all retained electrical cables and connections and perform electrical operational test, megohmmeter test, grounding and voltage drop measurements. All findings shall be reported to the Authority.

- **Electrical Operational Test:** Contractor shall perform an operational test of all new and retained cables and equipment. Operation of the new and existing systems and equipment shall be performed to the satisfaction of the Authority.

- **Insulation Resistance (Megohmmeter) Test:**

- Insulation resistance and continuity test shall be accomplished on cables installed for new, retained, modified, or repaired systems.
- Contractor shall conduct insulation resistance test, using a 500VDC megger, of electrical conductors in all retained and newly installed cables before hook-up. Minimum acceptable reading of cable conductor to ground and between IC conductors is 0.05 Megohm. Minimum acceptable reading of cable conductor to ground between power and light conductors is 0.5 Megohm. Test circuits for continuity and to ensure all terminal connections are tight.

Caution: Do not megger electronic circuits.

- Contractor shall verify by operational check that all equipment is operating satisfactorily in primary and casualty configurations.

- **Electrical Ground Test:**

- Ensure that the housing/enclosure casings of the electrical apparatus are properly safety-grounded to the ship's grounding system to prevent accidental electrical shock to shipboard personnel.
- Conduct a test of new, retained, modified, overhauled, or repaired electrical equipment enclosures for continuity and resistance of grounding path. Resistance of grounding path between equipment enclosure and a ship structure member shall not exceed 0.1 Ohms. Correct any deficiency prior to energizing the circuits.

321.7 SHORE POWER RECEPTACLE & CABLES

The shore power receptacle shall be inspected and requalified. This connection shall include an isolation transformer or a galvanic isolator and shall be fitted with a watertight cap with lanyard. Contractor shall inspect all shore power receptacle wiring for damage and replace if needed.

The Contractor shall provide one (1) new properly sized, 75-foot long, shore power cable per vessel with plugs to match the vessels' shore power connections, for use with the vessel docked and plugged in at any of the Authority's docks. The Authority shall be responsible

for providing the shore end connector model, make and manufacture information to be used by the Contractor for purchase and installation.

321.8 120V POWER RECEPTACLES

The Contractor shall remove and replace all existing electrical outlets on the vessel with new, in-kind. Electrical outlets shall be rated for 120Volts, rated for the correct amperage of the circuit they are on and suitable for marine use. Electrical outlets shall be upgraded in the following spaces:

- **Pilothouse** – Existing outlets shall be removed and replaced. Two new outlets shall also be added for general purpose use. Additional wiring and/or outlets shall be added as required to support the upgraded navigation and communications electronics and other equipment as required by Section 400.
- **Upper Deck Passenger Area** – Electrical outlets located on weather decks shall be removed and replaced with new weather tight outlets rated for marine exterior use, they shall be provided with weather proof covers for when not in use.
- **Main Deck Passenger Area** – The Contractor shall propose a plan to install bulkhead mounted electrical outlets, mounted at an accessible height, at all outboard seating locations. The Contractor shall ensure that each outlet is located to avoid interference that would hinder passengers from plugging in a typical power plug or cell phone charger. The Contractor shall also submit for Authority review and approval a plan to install electrical outlets for the use of passengers seated in the inboard seating. Electrical outlet locations and installation shall be approved by the Authority.

All new electrical outlets shall be duplex, tamper resistant, with dual USB charging ports suitable for marine use. Where space is limited, the use of USB outlets may be substituted for conventional electrical outlets.

- **Commissary Area** - Commissary electrical outlets shall be suitable for specific use (See Section 651 Commissary Space). Electrical outlets located in the Commissary shall be ground fault interrupted (GFI) type outlets and shall be located per the Authority-approved Commissary design (see Section 324.4).
- **P/S Main Engine Rooms** – replace in-kind with new
- **P/S Aft Jet rooms** – replace in-kind with new
- **Fore/Aft Upper Deck** – replace in-kind with new

321.9 SWITCHES

Switches shall be removed and replaced in-kind with new.

324 SWITCHBOARD & POWER PANELS

324.1 MAIN SWITCHBOARD

The Contractor shall remove the existing main switchboard in each vessel and install a new non-paralleling main switchboard, IEM Marine or approved equal, with input for two SSDGs and shore power and all outputs required by the Contractor's electric analyses and one-line diagrams. Metering and indicators for current, voltage, ground fault, and power available will be provided by the Contractor as per USCG requirements.

The installation shall include foundation modifications as required; cable re-routing and additions; relocation of interferences; and replacement of and splicing of cables, as required. The Contractor is responsible for development of the switchboard design including foundation modifications and potential interferences. The new main switchboard shall be designed and built in accordance with USCG standards for marine drip-proof construction and CFR Subchapter "J".

The new main switchboard is to be tested to the requirements of the CFR and to the approval of the attending USCG inspector and Authority. If the attending USCG Inspector requires DVTP, FMEA, and PSTD documentation, the Contractor shall generate these test documents and make submittals to USCG/MSC in advance of testing. Tests shall cover both ship's power and shore power. A Circuit Breaker Coordination Study and Fault Current Analysis/Short Circuit Study shall be generated by the Contractor and submitted to USCG/MSC. If USCG/MSC comments are received, they shall be addressed by the Contractor and resubmitted until approval is received.

Electrical junction boxes will not be allowed to be installed under engine room floor plates in accordance with the requirements of the CFR and IEEE.

324.1.1 INSTALLATION

Installation of switchboards shall be as per the Manufacturer's recommendations and to the applicable IEEE, ABS and USCG requirements. The switchboards shall be secured to solid foundations, shall clear the overhead deck beams by at least 4", and shall be braced to the bulkhead or deck above. Braces shall be installed with bolts and shall not be welded to the switchboard structure.

Bracing structure shall have sufficient flex to allow for ship's structure deflection. A clear working space of a minimum of 36" shall be provided in front of the switchboard.

It is possible that the new switchboards may not have the same footprints or heights as the existing switchboards. in such a case, the Contractor is responsible for any necessary modifications to the existing switchboard foundations to accommodate the new switchboards. These modifications shall include framing, supports, and deck plating surrounding the new switchboards. All switchboard access doors shall be clear to open fully.

There shall be no new piping routed over the switchboards. Any existing piping which runs over the new switchboards shall be re-routed to be clear.

324.1.2 DEAD ENDED CABLES

If the Contractor finds dead ended cables within the existing switchboards due to modifications over the years. The Contractor is responsible to trace out, identify, and remove all dead ended cables. The cost for this work shall be to the Contractor's account. It is recommended that the Contractor ship check the existing main and emergency switchboards prior to submitting a Contract bid.

324.1.3 LOW VOLTAGE TRIPS

Switchboard circuit breakers servicing equipment that must have emergency shutdown capability per the CFR must be fitted with low voltage trips. This equipment includes ventilation panels, engine room vent fans, lube oil pumps, etc.

The new main switchboard shall be tested under full load conditions to the approval of the attending USCG Inspector during Dock Trials. This test shall include a test demonstrating control of both ship service generators, shore power connections, operation of all circuits, and operational tests of all gauges, indicator lights and alarms.

324.1.4 BREAKERS

Switchboard breakers shall be by Authority approved.

324.2 POWER PANELS & CIRCUIT BREAKERS

Contractor shall remove and dispose of the existing distribution breaker panels:

- Pilothouse Panel – installed on the aft bulkhead of the pilothouse.
- Heat/AC Panel – installed in the main passenger cabin under the port stairs.
- Engine Room Panels – One located in each engine room (port & starboard)

Contractor shall provide and install new power panels and circuit breakers (see Section 324) in accordance with the Contractor's load analysis and one-line diagrams to meet the electrical requirements of the overhauled vessels, including all modifications. Critical loads shall be on a separate panel.

Power panels and circuit breakers shall be Square D or approved equal. The new power panels must meet the requirements of IEEE STD 45, Section 023.1 and 46 CFR Subchapter J. The Contractor shall propose an electrical distribution scheme showing panel locations and details.

Power and lighting panels accessible to passengers shall have latches with locks keyed alike. Labels are to be provided on each panel showing designation, voltage, and bus rating. A circuit directory card mounted in a plastic faced holder shall be completed and posted inside

each panel door. Panels located in the engine rooms shall be NEMA 12, with doors fitted with gaskets. Panels located in passenger spaces and crew operating spaces shall be NEMA 1 or better.

324.3 CIRCUIT BREAKERS

Each breaker shall have sufficient interrupting capacity to safely interrupt the maximum fault current obtainable at its point of application.

Circuit breakers shall be of the commercial molded case type, quick-make, quick-break, with inverse time tripping characteristics on overloads and instantaneous trip device for short circuits, except as noted. Two and three pole breakers shall have common trip handles. Breakers shall clearly show when they have been tripped by over-current and be marked with amperage size.

The Contractor shall provide panels with one spare circuit breaker and space for one additional breaker for every ten active circuits or fraction thereof. Spares shall be representative of the breaker sizes used in that panel.

324.4 COMMISSARY

Equipment that is normally supplied with connection terminals shall be connected “hard-wired” to a branch circuit through dedicated junction boxes under the counter and concealed from public view. The Contractor shall submit the electrical layout for review, including the locations of outlets.

331 LIGHTING FIXTURES & ILLUMINATION

All fluorescent lighting fixtures and associated wiring aboard the vessels shall be removed by the Contractor and replaced with new lights and wiring. LED lighting shall be used wherever possible. Contractor shall be responsible for developing a lighting plan that provides adequate lighting throughout, as required by Section 331.1. Contractor's design shall integrate adjustable lighting levels for Authority approval and shall allow a minimum of 3 settings: day, night, and cleaning (all lights full power).

Fixtures shall be designed for marine use and for the particular location and service required and shall conform to the applicable requirements of UL1598, UL1598A and UL595.

Main lighting power feeds may be retained where possible and at the approval of the Authority. Branch lines shall be pulled back to the first junction box and replaced in accordance with the lighting plan. The Contractor shall provide and install any new cable runs as required to provide a fully operational lighting system that is approved by the attending USCG Inspector.

The types and quantities of lighting fixtures described in the following sections are intended as a guide only. The provided lighting shall not be less than this guide, unless approved by the Authority.

331.1 REFLECTED CEILING PLAN/LIGHTING PLAN AND LIGHTING LEVELS

The Contractor shall provide a Reflected Ceiling & Lighting Plan in accordance with Publication UL595 Standards detailing type and number of light fixtures. Lighting levels shall be proposed by the Contractor for Authority review. The plan shall indicate all vessel lighting, including the main passenger cabin, heads, commissary, exterior lighting on the main and upper decks, pilothouse, voids, equipment spaces, emergency lighting, navigation lights, search lights and flood lights. In addition, Contractor shall provide a plan for adding step lights to the two exterior stairways (see Section 331.12).

Contractor shall ensure that no lighting on the vessel creates objectionable glare in the pilothouse. If it is determined by the Authority, or the Authority's representative during night trials that any part of the vessel is producing light that causes a glare for the operator, Contractor is responsible for making any alterations to remove the glare.

Lighting level and locations shall be sufficient to charge the LLEPM markings required by Section 602.6.

331.2 MAIN CABIN LIGHTING

The Contractor shall provide and install new LED interior lighting fixtures in accordance with the approved Reflected Ceiling & Lighting Plan. Interior lighting shall be recessed 6" LED down light fixtures, Pauluhn LED DLL14-40K, or approved equal. Lighting shall be sufficient to charge the High Performance Photoluminescent (HPPL) exit path markings required by Section 602.6.

Interior main deck lighting shall be switched from the main deck distribution panel.

331.3 PASSENGER HEADS

Contractor shall remove all lighting in the passenger heads and install a new 120V discharge fan/LED light and a new 120V LED mirror light.

331.4 COMMISSARY

Contractor shall install three (3) 120V Decorative LED accent lights over commissary bar as part of the main cabin lighting.

331.5 WORK SPACE LIGHTING

The Contractor shall remove the installed work space lighting and provide and install adequate lighting for all work spaces, machinery spaces, voids, and storage spaces. Machinery space lighting shall be provided with surface mount LED fixtures, as indicated on the Authority-approved reflected ceiling plan/lighting plan. LED lighting for lockers, storage spaces, voids, etc. as detailed shall be provided.

Interior hull void lighting shall be switched locally. Jet room and engine room lighting shall be switched adjacent to accesses.

331.6 EXTERIOR LIGHTING

The locations of existing exterior deck lighting fixtures shall be retained. The Contractor shall provide and install new LED deck lighting fixtures one-for-one to the approval of the Authority in all deck lighting locations, unless otherwise recommended by the Contractor in the Reflected Ceiling Plan. All exterior lights shall be switched from the pilothouse distribution panel or pilothouse navigation light panel as appropriate. LED lighting shall be used wherever applicable.

All cable runs to exterior lighting shall be pulled back to the first junction box and replaced with new cable. Existing cable clips for runs shall be removed and new aluminum clips shall be installed.

331.7 PILOTHOUSE

Pilothouse lighting shall be removed and replaced with new LED lighting of equivalent illumination per the Contractor's reflected ceiling plan. Newly installed lighting shall be recessed 6" LED down light fixtures, Pauluhn LED DLL14-40K, or approved equal. Contractor shall also install at least one (1) 24V Red LED (on Emergency Circuit), and one (1) 120V desk lamp w/red filter.

331.8 NAVIGATION LIGHTS & PANEL

Navigation lights shall be replaced per Section 422.

331.9 FLOODLIGHTS

Existing floodlights shall be removed and replaced by LED floodlights of similar or better illumination level. Floodlight power cables shall be removed back to the first J-box and replaced.

The Contractor shall provide and install new LED floodlights in positions that will adequately light the IBA launch area(s). These floodlights shall be located to the approval of the USCG attending inspector and the Authority.

331.10 SEARCHLIGHT

The existing search light shall be removed and replaced with a new 115V, 350W, 25M Candela, remote control search light with anti-icing heater.

331.11 EMERGENCY LIGHTING

Emergency lighting shall be provided and installed to meet the requirements of Subchapter "T"; 46 CFR 183.432(a) thru (b) (4) and applicable sections of 46 CFR, as listed in Section 313.1. Lighting shall be adequate to illuminate exit paths to the bow loading doors and the aft port & starboard side loading doors. Emergency lighting in crew areas shall be adequate to allow for emergency operations. All installations shall be to the approval of the USCG and

the Authority. Interior passenger area emergency lights shall be LED recessed cans. Exterior lights shall be LED, guarded fixtures.

331.12 STEP LIGHTS

Contractor shall add one LED light per step to illuminate the treads, per an Authority approved plan. The lights shall be recessed into the steps and provided with adequate protection from weather. Wiring and junctions shall be protected from vibration, chafing, and weather. The design shall incorporate easy access for bulb changeouts.

Stairway lights shall either be capable of charging LLEPM stair nosings or shall have another method of remaining illuminated during loss of the SSDG power per the requirements of the applicable standards referenced in Section 602.6.

331.13 UTILITY SPACE LIGHT

Contractor shall add one LED light in the utility closet required by Section 654.

400. NAVIGATION, COMMUNICATION AND SAFETY EQUIPMENT

421 NAVIGATION SYSTEMS

421.1 FLAGS & SHAPES

The Contractor shall provide two (2), 24" diameter, black portable, nylon folding Not-Under-Command balls to comply with COLREGS. These shall be stowed in the pilothouse with line and hardware for rapid deployment.

The Contractor shall provide one (1) 3' x 5' US Flag and one (1) red fueling pennant. Masts shall be rigged with new flag halyards and hardware (blocks & clips) for the ensign and two signal pennants. See Section 171.

421.2 EMERGENCY SIGNALS

The Contractor shall provide twelve (12) new hand held, rocket propelled, red emergency flares in a watertight plastic box to be stowed in the pilothouse. Flares shall have an expiration date approximately 42 months from time of delivery of the vessel.

421.3 EPIRB

The vessels are not currently equipped with an EPIRB. Contractor shall provide and install a new GPS-capable Category 1 – 406/121.5 MHz, float-free, automatically activated EPIRB for vessel delivery and operation to 25 miles from a safe harbor of refuge. Contractor shall be responsible for registering the EPIRB per Section 003.3.

421.4 ANCHOR SIGNAL BELL

The Contractor shall clean the brass bell and bell bracket. All hardware shall be replaced with new.

421.5 MAGNETIC COMPASS

The magnetic compass shall be removed. Contractor's console arrangement, to be approved by the Authority, shall dictate whether the compass is reinstalled in the modified console, or replaced with a smaller compass. If replaced with new, the compass make and model shall be submitted for Authority approval. The compass shall be installed on centerline in the console. Prior to delivery, the compass shall be "swung," and a Deviation Card provided as per Section 988.

421.6 SHIP'S HORN

The Contractor shall overhaul the existing air horn to like-new condition. Air tank, compressor, piping and valves shall be replaced with new. Wiring shall be inspected for wear or damage and shall be replaced as necessary. The horn after overhaul shall meet all regulatory requirements and shall undergo no change in pitch.

421.7 THERMAL IMAGING CAMERA

The Contractor shall provide and install a FLIR M324, or equal, Thermal Imaging Camera and interface with a NAVNET, or equal, display.

422 NAVIGATION LIGHTS & PANEL

Navigation lights shall be replaced with new, arranged to comply with the requirements of the Inland Rules of the Road sections of the COLREGS. Navigation lights shall be “LED” and USCG approved, and shall include, but are not limited to:

- 2 sidelights (one green, one red) 10-point, double lamp
- 1 masthead light (white, forward and range) 20-point, double lamp
- 1 stern light (white) 12-point, double lamp
- 1 anchor light (white) all round, single lamp
- 2 not under command (red) all round, single lamp

Wiring shall be removed back to the first junction box and replaced with new. The Contractor shall provide and install a Coast Guard approved, 24V DC navigation light panel in the pilothouse. Panel is to be compliant with IEEE Standard 45 Section 34.2 and USCG 46 CFR 111.75-17.

423 NAVIGATION & EXTERIOR COMMUNICATION SYSTEMS (ELECTRONIC)

Upon arrival of the vessel in the Contractor’s shipyard, the Contractor will turn on all navigating equipment that is to be retained and functionally test it. Items to be retained shall be inventoried, securely packaged and stored in a secure, weather protected storage in the Contractor’s facility. The inventory shall be provided to the Authority.

All other Electronic Navigation equipment that is NOT to be retained for re-installation shall be removed to temporary storage to enable the Authority to determine disposition. Equipment designated for scrap, shall be scrapped by the Contractor. Equipment to be returned to the Authority’s inventory shall be crated and labelled for shipment on board the vessel or by the Authority transport and discretion.

The Contractor shall provide and install new the following electronic navigation systems (or equal) on or in the pilothouse console, per the Authority approved pilothouse mock-up required by Section 646.1. The following components shall be used as a guide. To the extent possible, the functionality and arrangement of the navigation electronics equipment shall be similar to that on the Authority’s vessels *Champion* and *Glory* to ease the transition of captains from one vessel to another. It is imperative that the following equipment be supplied as a fully integrated package, from a single manufacturer:

- 2 GPS:
 - Furuno Model GP 330B (or Authority approved) w/antenna (2 independent systems, with inter-switch connection)
- 2 RADAR:
 - Furuno Model DRS12A X-Class 12kW (Authority approved).
 - Furuno Model DRS6A X-Class 6kW (Authority approved).
 - Radars shall be configured as two independent systems with inter-switch connection and shall both interface with GPS and AIS.
- 3 MULTIFUNCTION DISPLAYS:
 - 3 Multi-Function Display (MFD) TZT14 series or equivalent, latest model NAVNET (Authority approved)
 - 1 Remote Control MCU 002 or equivalent to interface to the MFD's
- 1 HUB:
 - HUB 101 (Furuno Ethernet Hub, or equal, connecting all navigation systems)
- 1 COMPASS:
 - RATE COMPASS PG700 R (Authority approved)
- 1 DIGITAL DEPTH SOUNDER:
 - Furuno 500 series (Authority approved) w/transducer
- 2 POWER SUPPLIES:
 - PSU 012 (Authority approved)
- 1 AIS:
 - The AIS shall be retained per section 446.1 and integrated with the navigation electronics package.

See Sections 233.1, 438-441, & 446 for additional pilothouse electronic equipment.

431 VESSEL MONITORING SYSTEM

431.1 FUEL CONSUMPTION MONITORING & REPORTING

The Contractor shall provide, integrate and install a remote monitoring system using GP Link or Authority approved equal. The system shall allow the Authority to view the location of the vessel in real time and report heading and speed. The monitoring system shall provide:

- fuel use rates
- fuel consumption over time
- fuel consumption by individual trips incorporating geofencing at all docks utilized by these vessels in MBTA Ferry service

The Authority prefers that fuel consumption be calculated based on fuel burn rates rather than fuel tank levels, as fuel tank level measurements are susceptible to inaccuracy based on movement of the fuel in the tank when the vessel leans, accelerates or decelerates. Data shall be accessible and downloadable via password-protected user IDs from any Windows-based computer over the internet. Reporting shall be configurable to provide monthly reports of fuel consumption.

At a minimum geofencing shall include the following locations:

- Long Wharf
- Logan Airport
- Pemberton Point, Hull
- Hewitt's Cove, Hingham
- Quincy Layover Facility
- George's Island
- Grape Island
- Spectacle Island
- Up to four (4) other locations, as directed by the Authority

431.2 ON TIME PERFORMANCE (OTP) REPORTING

The vessel monitoring system shall also use geofencing or other appropriate technology, to monitor and remotely track On Time Performance (OTP) with the ability to generate and create performance reports. The system shall be able to report arrival and departure times to/from the relevant geofences to the nearest 5 seconds, or other Authority approved accuracy

level, and shall include the ability to add an Authority-determined additional duration to replicate the actual arrival and departure time to/from the dock. The system shall also be configured to interface with and output OTP data directly to the Authority's TRMS maintenance management system.

The system, integration, design details, and format of data output shall be submitted for Authority review and approval.

432 TELEPHONE/INTERCOM SYSTEM

The vessels do not contain an intercom system. The Contractor shall provide and install an intercom between the pilothouse, the main deck commissary, and the bow loading doors for crew communication to be approved by the Authority. The Intercom shall be equipped with an audible and visual attention signal and an acknowledgement switch.

433 PUBLIC ADDRESS SYSTEMS

The Contractor shall remove the installed public address system, including wiring. Contractor shall provide and install a new commercial, marine quality public address system. This system shall be USCG approved and capable of being heard in all passenger spaces and crew work areas on the vessel (interior and exterior). The system shall be operated from the pilothouse and shall be capable of making dual mode, audible and visual, announcements via integration with the Passenger Information System required by Section 435. The system shall be ADA compliant, suitable for the hearing impaired, meeting or exceeding the requirements contained within the PVAG. Power shall be supplied by an emergency power circuit. PA speakers shall be ceiling recessed style.

The public address system shall be complete, incorporating the following equipment:

- Pilothouse microphone
- AM-FM tuner with marine antenna
- Amplifier
- Exterior and interior speakers
- Volume control module
- Equalizer module
- Power conditioner module

The system shall be split into exterior and interior zones.

This system shall be designed to function in tandem with the Passenger Information System described in 434.3. In the event of an emergency, passengers shall be alerted by two functions:

- PA announcement
- Visual electronic sign information

433.1 LOUD HAILER AND CREW COMMUNICATIONS

The Contractor shall replace the existing loud hailer and crew speaker system, including cabling, with a new, commercial, marine grade loud hailer and intercom speaker system. The new system shall be arranged so that the pilothouse can communicate with the personnel manning the forward and aft (P&S) docking and passenger loading stations. A second “back-up” loud hailer capability shall be provided via one of the VHF Loud Hailer functions (See Section 441).

Speakers which are weather-exposed shall be of watertight construction and mounted and secured to withstand all operating elements including salt spray, vessel vibration, vessel pounding, extremes of temperature, and normal operational service. The equipment shall not cause radio interference.

434 WI-FI

Contractor shall remove the existing Wi-Fi system in the vessels and shall provide and install a new Wi-Fi system. This system shall include a mobile transceiver that shall be mounted in the pilot house. Wi-Fi access point “nodes” shall be installed in locations to provide coverage throughout the main deck passenger area. An exterior antenna shall be installed in a location to prevent the signal from being lost during vessel course changes. The antenna shall provide the Wi-Fi system with “seamless” connectivity. The Contractor shall be responsible for the complete system installation. This is expected to include, at a minimum, new cabling, wiring, hardware and software.

The Contractor shall submit the proposed design including device locations, base controller location, conduit runs, and wiring to the Authority for review and acceptance. Cables shall be routed above the removable ceiling panels.

Contractor shall be responsible for all billing, service plans and/or re-occurring cost associated with the Wi-Fi system from the initial installation and activation through the end of the vessel’s warranty. All billing, service plans and/or re-occurring cost associated with Wi-Fi system after expiration of the vessel’s warranty shall be directed to the Authority at:

Deputy Director of Finance – Railroad Operations & Water Transportation
Massachusetts Bay Transportation Authority
1 South Station, 2nd Floor
Boston, MA. 02110

435 PASSENGER INFORMATION SYSTEM

Contractor shall provide and install a system to provide automatic audible and visual terminal and route notification on the vessel, as well as the USCG required safety announcement. All the

equipment provided shall be of robust design suitable for use in a vessel operating in the marine environment of Boston Harbor and adjacent waters.

A system and equipment that has a proven history of operation and reliability in public transportation/ferry service shall be provided and installed by the Contractor. All system equipment supplied shall be marine quality, suited for the temperature, humidity, shock and other shipboard environmental conditions. Technical representative service for the system must be conveniently available in the Authority's service area. The system provided must not interfere with or prevent the continued normal operation of vessel navigation and/or communication equipment. The Contractor shall be responsible for the design, installation, testing, and warranty of the system.

All Customer Service Information must be broadcast in dual-mode, audible and visual. This system shall adjust to ambient noise levels and shall be interoperable with all visual display systems such that the auditory announcement is simultaneously displayed visually. VMS equipment shall display visual announcements similar in content and clarity to auditory announcements.

The Passenger Information System shall provide for:

1. Audio and Visual Announcements in both interior and exterior passenger spaces.
2. Electronic Interior Message Display, four (4) total (1 forward and two aft P&S, 1 on upper deck).
3. Electronic Exterior Message Display, three (3) total. Located one forward and one on each side to display messages to passengers dockside.
4. Amplified PA horn/speaker(s) at each passenger loading area, to make announcements to passengers dockside
5. Interface to interior PA horn/speaker and amplifier system
6. Interface to wheelhouse microphones
7. Control unit or units to control new functionality and hardware
8. Operator interface, to be located in the bridge, to allow system set-up, announcement activation, and other user required functions
9. Portable test system to allow for fault isolation and system maintenance
10. User-friendly equipment to provide the Authority the ability to quickly and easily modify the audio and visual information produced by the system and to allow those changes to be easily updated on the vessel by the Authority.

The system shall use LCD screens for visual display of the passenger information on the interior and upper deck message signs, rather than one-line scrolling message signs. Screens should be of

sufficient size to allow longer messages, such as the USCG-required safety announcement, to be displayed in ADA-compliant text, i.e. the screens should be able to display one or more sentences at a time.

The front and side facing exterior message signs shall be of an Authority-approved design, including the installation. Sign housings shall be non-fogging, constructed of aluminum or stainless steel to prevent corrosion. If possible, the signs shall be recessed with adequate seals to prevent water and salt ingress. Contractor's design shall be submitted for review, including any historic performance information from other applications of the system/components.

The Passenger Information System shall conform to the requirements of IEEE Standard 1477-1998, IEEE Standard for Passenger Information Systems for Rail Transit Vehicles or an equivalent maritime standard for the equipment specified. Deviations which shall be required to conform to vessel design shall be approved by the Authority. The Contractor is encouraged to propose systems and equipment that provide the required functionality listed above and that have a proven service history.

The Contractor shall provide their Vendor's detailed proposal (without financial information) to the Authority prior to issuing a purchase order for the Passenger Information System. This proposal shall include complete information on the details of the IEEE (or other) standards applicable to the system as well as details of the visual presentations of character size, brightness, etc. The Contractor shall receive written approval of the system from the Authority prior to purchase.

The following system features shall be incorporated:

1. Messages shall be digitally stored and presented to the passengers at the designated times. Digitally recorded audio messages shall be broadcast over the Public Address system (see Section 433). Textual messages synchronized with the audio messages shall be displayed on all message display units to be provided.
2. Vessel crew manual (PA) announcements shall override the electronic announcements. The system shall allow the operator to utilize the existing manual system via the pilothouse PA microphone to make announcements. A two-tone announcement is to be made on all the speakers when this manual (PA) announcements function is initiated.
3. A test feature shall be provided that will, when activated, cause a test announcement and interior display message to be repeated every 10.0 seconds until the test feature is deactivated.
4. A minimum of 100 interior messages shall be programmable and stored for selection. Each message shall be capable of containing up to 512 characters of text and 60 seconds of audio. It shall be possible to store each message with an identifying name of up to sixteen (16) characters that will be displayed to end users on the Operator Interface.

5. A minimum of 30 exterior messages shall be programmable by the Authority and reside in the system for selection, each containing up to five “pages” of information to be cycled continuously on the exterior displays. It must be possible to store each message with an identifying name of up to sixteen (16) characters that will be displayed to end users on the Operator Interface.
6. The system must be designed to ensure that the audio announcements are capable of being transmitted onto the existing PA to allow for broadcast of an automated message, generated as if it were a normal PA announcement.
7. The system and its components should provide a minimum service life of 10 years without need for overhaul or the need for routine or planned repair or replacement of components.
8. Internal announcements shall be audible throughout passenger areas and external announcements shall be audible dockside at least twenty-five (25) feet from the vessel with engines running under normal operation.
9. The system shall have an automatic gain control function that detects ambient noise both in the interior and exterior areas and adjusts announcement volume automatically. Manual volume control, and the ability to activate or deactivate the automatic gain control, must also be provided on the Operator Interface. The calibration of the automatic gain control will be approved by the Authority during the design review phase of the contract but must also be adjustable by the Authority at a later date.
10. Authority Programming of messages shall be accomplished in a straightforward, intuitive format as to allow any person with basic computer skills to make changes or alter messages.

Modifications to stored messages shall be via a serial link to a portable computer, or other Authority approved method. At least 30 days prior to vessel delivery the Contractor shall provide one complete set of equipment, per vessel, for the recording and modification of the visual and audible messages **[CDRL 435-1]**. This equipment shall include everything required to reprogram the onboard system with new messages.

Authority-specific software developed for the Passenger Information System (i.e. station announcements, etc.) shall be escrowed for a ten-year support requirement.

436 SAFETY DEVICES

The Contractor is responsible for providing and installing all safety devices required by USCG regulations, including the following. All devices shall be marked in accordance with the requirements of 46 CFR 185.604.

436.1 LIFE RINGS

USCG Approved orange life rings, 30" diameter, are presently installed. They shall be removed and discarded and replaced with new life rings with approved strobe light and life line. Any associated modifications to, or replacement of the storage racks shall be made by the Contractor. Life rings shall be stenciled with the vessel name and hailing port.

436.2 JASON'S CRADLE RESCUE DEVICE

The Jason's Cradle rescue device shall be removed and stored off the vessel in the Contractor's secure, weather-protected storage during the Contract. Prior to sea trials, Contractor shall replace the line with new and shall place the Jason's Cradle device back in its storage location.

436.3 LIFE PRESERVERS (PFDs)

The existing Life Preservers (PFDs) shall be inventoried and removed by the Contractor to a secure, weather protected, off-the-vessel storage area upon delivery to the Contractor's venue.

An additional 34 type I child PFDs shall be supplied by the Contractor to bring the total count to 50. Each shall be stenciled with vessel name [Note: This count exceeds the 10% Rule; however, 46 CFR199.70 requires one child PFD for every child carried on board. Recent USCG inspections in the Providence and Boston Sectors have focused on PFD counts to cover all children on board. (50) Child PFD units will cover a bus load of "field trippers," and will be a prudent Child PFD count].

Storage for adult-sized PFD's for all seats & crew members in the main deck seating area shall remain under the main deck passenger seats. All other adult-sized PFDs shall be located in a new fiberglass or aluminum storage box on the vessel's upper deck – storage box and location to be approved by the Authority. The child-sized PFDs shall be evenly distributed between the upper and lower deck storage locations.

436.4 AUTOMATED EXTERNAL DEFIBRILLATOR (AED)

Contractor shall remove appropriately dispose of the AED from each vessel.. Contractor shall incorporate an AED storage location into the main passenger cabin to the approval of the Authority. Contractor shall coordinate with the Authority to determine the final dimensions, as the Authority will provide a new AED and storage container for each vessel.

436.5 FIRST AID KIT

Contractor shall remove and dispose of the first aid kit in each vessel. Contractor shall provide and mount a new USCG approved first aid kit in the pilothouse of each vessel.

436.6 WORK SAFETY VEST

Contractor shall provide two (2) new work safety vests for each vessel. Each vest shall be labeled with the vessel name. One vest on each vessel shall be provided with a 50' tether and snap shackle.

436.7 EVACUATION CHAIR

The Contractor shall provide and install a Stryker Emergency Chair Model 6254-000-000, including Stryker stowage equipment. Contractor shall submit drawings of the planned installation location and method to the Authority for review and approval. Stowage equipment shall consist of a Stryker Storage Cabinet #6253-002-000. The Stryker chair shall be provided with a locking rear lift handle and spare parts inventory. Installation shall be to the approval of the Authority.

436.8 INFLATABLE BUOYANT APPARATUS (IBA)

The Contractor shall provide and install on each vessel USCG approved IBA units with adequate capacity for the maximum number of passengers and crew, per the USCG Certificate of Inspection. These units shall be complete with cradles, hydrostatic releases, and all appropriate securing and launch hardware and equipment. The IBA units shall be arranged so that launch does not require physical carrying across deck surfaces.

The IBAs provided shall be capable of being serviced annually by a Southeastern New England Service Agent that is certified by the manufacturer and USCG to service these units. Each IBA shall have an inspection sticker complying with the requirements of 46 CFR 160.151.57.

All launch locations must be illuminated by a floodlight per the requirements of Section 331.9.

436.9 MISCELLANEOUS SAFETY & EMERGENCY EQUIPMENT

The Contractor shall remove all other miscellaneous portable safety and emergency equipment such as distress signals, EPIRB, etc. to the shipyard's secure storage area. This shall include pilothouse located documents, manuals, and magnetic compass. The Contractor shall replace this equipment prior to Dock Trials. Water lights shall have batteries removed. EPIRB shall be stored upside down in the shut-off mode.

438 SECURITY CLOSED CIRCUIT TV (CCTV)

The Contractor shall remove the installed CCTV system and all cabling and install a new Security CCTV system as detailed in this section, Section 440 (CCTV Cameras), and in Appendix C. The Contractor shall return all NVR equipment to the Authority. Note that a separate, Operator NVR to be integrated with the CCTV cameras is also described in Section 439.

The Security CCTV system shall be delivered as a complete, operational system, with all associated parts and components necessary for a fully functional system. The primary NVR must also be integrated with the Authority's existing shoreside CCTV system. The camera system and all associated hardware/software shall be in compliance with MBTA fleetwide security system standards. The Contractor shall be responsible for test and integration of the new system with MBTA's Security network in Boston, MA.

438.1 GENERAL DESCRIPTION

This section specifies the installation of a mobile IP based video surveillance system to be installed on the MBTA's ferries. The mobile IP video surveillance system shall integrate to the existing MBTA CCTV system that is a real time IP video system utilizing IP based cameras. The video is viewed throughout the MBTA system using the Genetec Security Center client.

The CCTV software installed on fleet hardware must support a non-proprietary, open architecture platform which is fully ONVIF profile S and G compliant and must have been granted the SAFETY Act Designation and Certification by the U.S Department of Homeland Security (DHS). Video management software must also be currently listed on DHS website at the time of bid.

The CCTV system utilizes the MBTA's Security Wide Area Network (SWAN) and MBTA's Wide Area Network (WAN) as a means of transmitting IP video to various locations throughout the MBTA system for viewing and recording. The system expansion shall incorporate IP fixed cameras, Multi-Stream Megapixel CCTV Cameras, video monitors, Network Video Recorders (NVRs)/Video Management Systems (VMSs), the Genetec software, network switches, codecs, and any other hardware or software required to transmit/receive video over an IP network for a complete and functional system.

The Genetec client allows MBTA personnel to access live and recorded video streams from any camera, encoder, DVR, or NVR on the system and to create and store video clips and snapshots locally. The Genetec clients are currently installed on multiple computer workstations within the six (6) Hub Centers, Operations Control Center, and on individual computer workstations throughout the MBTA network.

This contract requires the Contractor to coordinate with the MBTA Security and Emergency Management Department and MBTA's CCTV Maintenance Contractor (MCMC) via the MBTA Project Manager to inform them of, and schedule work associated with, integrating alarms and video streams with the existing Genetec core directories.

The Contractor shall fully integrate all of the new cameras and video streams into the Genetec system and shall geospatially place new icons onto new and existing system maps. The icons shall allow access to the camera's controls and video streams. The functionality shall match that of the existing integrated cameras. All camera device monitoring shall be activated and tested prior to each vessel being placed into service, this shall include, but not be limited to: status, loss of video, faults, failures, alarms, and all tampering related events/alarms.

All CCTV cameras/endpoints shall be entered into the Genetec system with nomenclature submitted to, and approved by, the MBTA Security and Emergency Management Department. All maps are required to properly represent the endpoint locations shall be in scaled format and may utilize the MBTA's CAD contract drawings. It is the Contractor's responsibility to convert/import/translate the CAD drawings into a format that is applicable for the project; all extraneous information shall be removed from the CAD drawing for a clear representation of the equipment installation. All device icons shall be based on the MBTA standards; if a

standard has not yet been established for a device, then the Contractor shall work with the MBTA to develop an icon standard for that device.

The Contractor shall configure all Fixed IP CCTV cameras to be set up to dual stream H.265 images. Fixed IP Cameras shall have one stream with a resolution of 1920x1080 and a frame rate of 8 fps or greater for NVR recording; and the other stream shall have a resolution of 1920x1080, and a frame rate of 15 fps or greater for live viewing. The 360 Degree IP Cameras shall each have four stitched H.264 800x600 streams representing different viewed angle ranges of the camera for a composite stream of 1600x1200 and a rate of 8 fps for NVR recording, and shall also output four streams of the same viewed angles at a resolution of 800x600 stitched for a composite stream of 1600x1200 and a rate of 15 fps, or greater, for live viewing. Before CCTV camera set-up, the Contractor shall verify all camera settings with the Engineer, or an MBTA representative. All live streams shall be either multicast streams sent directly from the camera to the clients, the VMS/NVR shall facilitate the connection, or the stream shall be replicated by a server on the MBTA network to avoid increased utilization of the 4G LTE. All recorded streams shall be via multicast or unicast stream from the camera to the Onboard Network Video Recorder. If multicast communication is not used to facilitate recording on the Security CCTV System identified in this section and the Operations NVR identified in Section 439, an additional stream per camera shall be provided to facilitate recording on the Operations NVR identified in Section 439. The compression on a camera shall not exceed 30%.

The CCTV system is currently in use by MBTA personnel and is considered a critical system for MBTA Operations and security. All system improvements and changes must be coordinated in advance to not impact operations. This may require the Contractor to perform installation, testing, upgrades or system outages at off-peak or non-revenue times.

For the purpose of Configuration Management, the Contractor must inform the MBTA of the length of time during which the Contractor will be making any system modifications. The dates and length of downtime of the system must be submitted in writing on the Contractor's letterhead to the Security and Emergency Management Department and the MBTA's MCMC via the MBTA project manager and must be approved by those groups. The Contractor shall complete all background maps, plan all alarms, and submit all licenses prior to doing any work on the MBTA's Genetec system. The Contractor must submit, at least 30 days in advance, for a two-week window in which to complete all work on the MBTA's Genetec system; the Contractor may submit for additional time, but time may be limited due to other active contracts needing access to the system. The Contractor must complete a backup of the system prior to working on the system. The Contractor shall label the backup media with the contents, date, and time of the backup. The Contractor must maintain this backup for at least 120 days after the updated software is put into use. It is the Contractor's responsibility to have the system back online prior to the start of revenue service.

The Contractor shall provide all configuration/setup/programming of new and existing video system components identified in this specification section for a complete working system. Device configuration settings shall be submitted to the Engineer and the MBTA for approval prior to installation.

The Contractor shall perform visual adjustments of each camera during installation to account for lighting conditions, desired view, and other environmental conditions.

The Contractor shall have present during the duration of the Contract a certified network engineer with a minimum of 5 years' experience in networking of large-scale wide area network projects to be involved with all aspects of system integration of networked devices. The Contractor must submit this key person's resume for approval by the MBTA within 10 days from Notice to Proceed. No work shall be allowed to proceed with components having a network interface if this key person is not involved. This person shall always be on-site when network integration is taking place. Failure to have this person on-site shall cause the MBTA to immediately stop work until this person is on-site, at the Contractor's expense. Shall this person no longer work for the Contractor, the Contractor shall immediately inform the MBTA and a replacement shall be submitted at that time.

The Contractor shall have on site a person who is certified by the manufacturer of the individual subsystems (NVR, Wireless Access Point, and Genetec) for all work on these systems. The Contractor must submit each person's resume for approval by the MBTA within 10 days from Notice to Proceed. No work shall be allowed to proceed on these systems if a certified person is not involved. This person shall always be on-site when work on these systems is taking place. Failure to have this person on-site shall cause the MBTA to immediately stop work until this person is on-site, at the Contractor's expense. Shall this person no longer work for the Contractor, the Contractor shall immediately inform the MBTA and a replacement shall be submitted at that time.

All Licenses necessary for the Genetec platform and any other integration shall be supplied by the Contractor for all CCTV, or other installed equipment, and for existing equipment as described in these specifications.

The Contractor shall coordinate SNMP Community Strings for all SNMP capable devices with the MBTA. The Contractor shall configure the Community String in all SNMP capable devices prior to deploying in the field. Any improper configurations shall be the sole responsibility of the Contractor to correct and shall be corrected within 48 hours of notification.

438.2 SUBMITTALS

Prior to approval of the system hardware and software components, the Contractor shall submit the proposed equipment vendors qualifications and a written statement from the vendors acknowledging that the hardware and software to be supplied shall meet all functionality as required within this specification.

The Contractor shall submit a typical block diagram indicating hardware and software components that shall be installed within each vessel.

The Contractor and vendor shall be prepared to demonstrate the equipment functionality within two weeks of submission and prior to vendor/equipment approval. The Contractor shall plan to demonstrate how this proposed equipment meets, or exceeds, all

functional/performance requirements of the proposed vendor solution. The Contractor shall, within ten days of NTP, demonstrate to the Engineer the offloading capabilities of the system. This demonstration shall take place at a location in the metro Boston, MA area.

The Contractor shall submit descriptive literature, including manufacturer specification sheets, for all mobile video surveillance system equipment and software functionality and materials proposed for use in accordance with the requirements of this Section for approval prior to fabrication, assembly, installation and testing.

Also, the Contractor shall submit the following to the Engineer for approval: Network diagram of complete system, illustrating proposed configuration and interconnections. The Network diagram shall include detailed network architecture of all related IP devices, IP schema, device bandwidth, configuration, and routing requirements.

Prior to ordering any equipment as required under this Section, submit three (3) copies of the following to the Engineer for approval:

1. Full technical data and manufacturer cut sheets for all equipment.
2. Specific plans showing details of the following:
 - a. All Camera enclosure locations and mounting details.
 - b. Cable details.
 - c. Light intensity ranges throughout the interior of the vessel (determined by actual field tests).
 - d. All Cameras field of vision.
 - 1). Submit schematic and wiring diagrams complete with terminal numbers.
 - 2). Submit NVR storage recording calculations, in days and hours.
 - 3). Submit procedures for programming and troubleshooting.
 - 4). Submit full interconnect diagram for overall system, including interface connections to existing equipment.
 - 5). Submit configuration plan for camera/NVR access levels.

Supply maintenance instruction manuals to the Engineer including information regarding installation and maintenance as follows:

1. Operational Description and Procedures
2. Troubleshooting and Routine Test Procedures
3. Adjustments and Alignment Procedures

4. Wiring Diagrams, Tables and Schematics

Prior to installing any equipment, submit to the Engineer for approval three (3) copies of a detailed field test procedure intended to ensure all components of the system are functioning properly, in accordance with these Specifications. The tests performed shall include the tests outlined in Paragraph 3.3 of this Section. The detailed test procedure shall include a description of all test equipment to be used and specific measurements and/or pass/fail criteria for each test.

Factory Tests: In the Contractor's shop, the Contractor shall install all software and configure all equipment to be installed on the vessel and test the system prior to installation on the vessel. The Contractor shall submit a sample factory test report for approval prior to beginning installations on the ferries. The factory test report shall include IP addresses, software and firmware revisions, part numbers, and serial numbers of the equipment tested and to be installed.

Test Procedures and Reports: Full details shall be submitted of the scheduled tests and the expected duration of all test procedures. Samples of all test report forms, and full details of the methods that the raw test data is to be reduced, shall be approved by the MBTA before commencement of system testing to be furnished under this Contract.

1. The test report shall identify the name of manufacturer, model numbers, serial numbers, and the last date of calibration of test instrumentation. Documentation shall be furnished to verify that test instruments have been calibrated not more than nine months prior to the tests. If a test instrument does not require calibration, it shall be highlighted in the report.
2. The test report shall include a list of attendees.
3. Certified test results for the system components tests shall be submitted within 30 days after the completion of each test. No equipment shall be released for shipment until certified test data is approved by the Authority. Copies of approved test procedures, raw data measured results, calculations and all data derived from tests shall be included as part of report. All test data shall be bound in one report. The test report shall be indexed and cross-referenced in an easily understood manner.

Certificate of Compliance: Submit a certificate of compliance that all components furnished meet the requirements specified herein.

Operation and Maintenance Manuals shall be submitted as listed below:

1. The Contractor shall furnish an operation and maintenance manual for each piece of equipment, unless otherwise specified herein. The manual shall be provided in softcopy only. The following identification shall be on the cover page: the words "OPERATING AND MAINTENANCE MANUAL", the name and location of the project, the name of the Contractor, the contract number, revision, and date. The manual shall include the names, addresses, and telephone numbers of each subcontractor furnishing or installing

equipment. In addition, include the local (Massachusetts area) representatives for each item of equipment. The manual shall have a table of contents and index. The manual shall be assembled to conform to the table of contents, including tab sheets placed before instructions covering the subject.

2. The Contractor shall electronically submit to the Engineer for approval the preliminary operation and maintenance manual at least 30 days prior to shipment of first relevant unit. The manual shall provide a clear explanation of the theory, operation, and maintenance of the equipment accompanied by photos and schematic, wiring and mechanical assembly diagrams, as required. The manual shall be indexed and cross-referenced in an easily understood manner. The manual shall be organized to include the following information:
 - a. Operating instructions.
 - b. Troubleshooting and fault isolation procedures for on-site level repair.
 - c. System equipment removal and replacement procedures.
 - d. A list of the replaceable components with images and part numbers.
 - e. A test procedure to verify the adequacy of repair work.
 - f. A preventive maintenance schedule and instructions for the replacement of any equipment.
 - g. A preventive maintenance schedule for inspection, removal, and replacement for each component.
 - h. A list of special tools provided by the manufacturer.
 - i. A list of recommended tools and test equipment as required for performing all maintenance tasks.
 - j. Recommended spare parts list for one year's operation.
 - k. Interchangeable parts list-showing parts common to items of equipment.
 - l. Equipment manufacturers' descriptive literature including catalog cut sheets.
 - m. As-built working drawings.
 - n. System component approved factory test reports.
 - o. The latest service bulletins with dates that describe service procedures.
 - p. Camera configuration, troubleshooting, fault diagnostics and default settings.

- q. The NVR software programming, troubleshooting, fault diagnostics, and shutdown procedures.
- r. All software screens to be utilized for graphic representation of physical locations of equipment installation.
- s. Update Operations Manual for CCTV system software modifications provided under this Contract.

438.3 REGULATORY REQUIREMENTS

The Contractor and Security CCTV system shall comply with all applicable requirements of the following:

1. National Electrical Code
2. Massachusetts Electrical Code
3. TIA
4. IEEE
5. ANSI
6. ETL
7. FCC
8. ISO
9. UL
10. IEC
11. RoHS
12. SAE

438.4 GENERAL EXECUTION REQUIREMENTS

Installation of all CCTV System equipment shall be in accordance with manufacturer's recommendations, approved shop drawings, and as shown on the Contract Drawings.

All systems and components taken out of service under this contract shall be turned over to the MBTA to be placed in spare parts inventory. Accompanying all turned over equipment shall be a status report of the condition of the device.

All wiring shall be neatly installed, and wire ways shall be utilized wherever possible. All wiring shall be identified at both ends by wire markers.

Furnish and install a complete and operable Video Surveillance System.

The Contractor is responsible for system start-up, performance testing and network testing, and the installation of all required interconnections for a fully functional system.

The Contractor is responsible for incidentals and appurtenances necessary to complete the work as specified herein and as shown on the Contract Drawings.

The Contractor shall program all cameras in-house. The Contractor shall not order equipment already addressed, as network IP addresses and the MBTA's IP schema is security sensitive information that shall not be disseminated.

Contractor shall provide as-built drawings, and operation and maintenance manuals.

438.5 INSTALLATION REQUIREMENTS

CCTV cameras shall be installed in locations with the orientations as approved by the Authority.

All mounting hardware shall be stainless steel, and of tamper proof design.

All penetrations through the vessel shall be properly sealed.

Supporting equipment shall be in a vessel communication cabinet as shown on the Contract Drawings.

Cabling to all CCTV cameras shall be CAT6 STP.

No Ethernet connected device shall be installed until its cabling is properly labeled.

The Contractor shall label each CCTV component with a label containing the following items:

1. 'MBTA'
2. The three-letter location designation
3. The device ID
4. A unique bar code

All labels used shall be machine printed white weatherproof labels and withstand rain, sleet, snow, dust, and temperatures of -20°F to 160°F. Font and font size shall be approved by the MBTA.

438.6 TESTING REQUIREMENTS

The contractor shall conduct electrical tests to demonstrate compliance with this Specification and with manufacturer's recommended test procedures as approved by the Engineer.

The Contractor shall supply all test equipment and software for all system tests. Test equipment shall have been calibrated within nine months of test.

CAT6 cable shall be tested after termination to ensure that the cable was not damaged during pulling and that it was properly terminated. The Engineer reserves the right to attend, or send a representative to, any cable testing that is performed.

A Wiremap test shall be performed on all CAT6A cables with a commercial off the shelf wiremap tester. The wiremap test shall ensure continuity of wires, absence of shorts, grounding, or any other wire pulling or termination problems or errors.

1. Specification sheets of the wiremap tester and test procedure shall be submitted to the Engineer for approval prior to the beginning of testing.
2. All tests shall be recorded with a description of which cable is being tested, a pass or fail, the reason for failure, the corrective action taken, the date, the time, and the technicians performing the test. Tests shall be re-run after the corrective action is taken. The test reports shall be submitted to the Engineer for approval.

An Ethernet bandwidth test shall also be performed on all CAT6 cables with commercial off the shelf handheld Ethernet bandwidth testers that perform RFC 2544 compliant tests at one Gigabit. The Ethernet bandwidth tester shall also be capable of saving test reports to internal or removable storage to be printed or made into a PDF. The test setup shall use one tester on each end of the cable and shall test bi-directionally.

1. Specification sheets of the Ethernet bandwidth testers and test procedure shall be submitted to the Engineer for approval prior to the beginning of any testing.
2. All tests shall be recorded with a description of which cable is being tested, the cable length as measured by the Ethernet bandwidth testers, the measured bandwidth, the Bit Error Rate, the date, the time, and the technicians performing the test. The test reports shall be submitted to the Engineer for review.

After the installation on each vessel is complete, the Contractor shall verify proper operation of all system software control functions, camera views, and video streams as described herein, to test all functionality of the CCTV System. The Contractor shall develop and submit a test plan and check off sheet for review by the Engineer 30 days prior to testing the first vessel, the test plan shall contain performance and failure testing of all levels and all components within the system and shall verify all aspects of the installation. The test plan shall include integration of the Mobile CCTV system into the MBTA Wide Area Network(s). Notify the Engineer a minimum of 14 days in advance of each test. Engineer or authorized representative reserves the right to attend and approve testing.

438.7 SOFTWARE UPDATE REQUIREMENTS

The system and/or any associated service contracts shall include a minimum of 5 years of major Genetec software release updates.

Updates will be bench tested for a minimum of 30 days by the Contractor and bench testing shall include all features and functionality as it exists in the enterprise systems.

All planned updates will be coordinated with the Authority to minimize the impact to revenue service.

439 OPERATOR NVR

The Contractor shall provide a secondary Network Video Recording system (“Operator NVR”) that shall be separate from, and additional to, the Genetec-based Security CCTV Mobile Network Video Recorder described in Section 438. The Operator NVR, however shall utilize additional streams from the same cameras recorded on the primary (Security CCTV) NVR. The Operator NVR shall be accessible to and used to support the ferry operations staff, including the Authority’s Railroad Operations department and its contracted ferry operator.

This networked digital video surveillance system shall be installed on each vessel. Details of the entire system including engineering, drawings, software function, performance, all the components and the installation shall be reviewed and approved by the Engineer through the design review process. The Operator NVR shall meet the requirements of Appendix C, as applicable.

The system shall consist of a Network Video Recorder (NVR) operating on an NVR platform that shall be submitted for approval by the Authority.

Any additional equipment such as computer interface cables, and software required for interfacing with the video surveillance system shall be furnished by the Contractor.

The system shall be powered from the vessel’s low voltage, ship’s service DC power system through a circuit breaker located to the approval of the Authority. The system shall be activated (start and stop recording) by a means approved by the Authority.

439.1 OPERATOR NETWORK VIDEO RECORDER (NVR)

The Operator network video recorder shall be a separate unit and it shall be key-locked, inside a key-locked steel enclosure. The Operator NVR locks on both vessels shall use the same key. The Operator NVR shall be shock-mounted and shall be located inside the pilothouse console. The recorder shall be able to withstand and continue recording when subjected to at least 5g shocks on any axis, and when subject to the shock and vibration requirements of EN50155.

The Operator NVR shall connect to the on-board network for transmittal of the information to directly communicate with any Windows-based computer, through supplied software. Electronic security measure(s) must be provided to enable the Authority to prevent unauthorized download of the recordings. The download function shall support downloading from either or both the normal SSD storage and the crashworthy storage.

The NVR shall be capable of recording all cameras at 30 frames per second, with each at 1920 x 1080 resolution. The NVR shall be capable of running for 24 hours a day/7 days a week without stopping.

The recording shall be done on a removable media solid state drive that will be used for video storage only.

All acquired data shall be written, stored, and encrypted. All data shall reside on the vessel on solid state drives (SSD) that are designed and applied for the purpose of mobile data acquisition and storage. The NVR and SSD shall be designed to be upgradable for increased storage. The storage provided shall be sized to hold 14 days of video at 15 fps from all cameras at full resolution.

The solid-state drive shall be able to be read at a remote location, without an NVR, via provided software and a converter cable that converts the drive signal to a standard input signal. The required converter cables shall be supplied by the Contractor.

The recording shall be date and time stamped along with the camera number, vessel name, and GPS position.

439.2 PILOTHOUSE DISPLAY

A display screen in the pilothouse shall cycle through images from all cameras, except as noted in Section 440. The pilothouse display screen shall be included in the pilothouse mock-up required by Section 646.1.

See Appendix C, Section C12 for additional information regarding the pilothouse display.

440 CCTV CAMERAS

The required minimum cameras are listed in Figure 1 below. The Contractor shall submit to the Authority for review and approval a CCTV coverage plan, indicating the locations of all cameras and the areas viewable from each camera.

The cameras shall be vandal resistant and shall be marine quality, suitable for the temperature, humidity, shock and other shipboard environmental conditions.

The cameras shall be IP-based Power Over Ethernet devices, with network connections provided by the NVR or through intermediate PoE switches via M12 connectors.

The cameras shall have adjustable resolution of at least 1920x1080 and have adjustable frame rates that support recording at 30 frames per second.

Cameras shall support MPEG-4 video compression of H.264 and H.265 and have proven history of reliable operation on transit vehicles or ferries

Each camera manufacturer and model shall be approved by the Engineer.

The camera mounting, adjustment and wiring shall be inaccessible when the camera is installed. All fastenings used in the camera installation which are accessible from the interior, shall be tamperproof type, approved by the Engineer.

Additional requirements for the CCTV cameras are detailed in Appendix C, Section C4, C5, C6, and C7.

Figure 1: Required CCTV Cameras

Quantity	Type	Description
4 minimum	Boarding areas at deck height	<p>These cameras shall be located at deck level at all boarding stations. At a minimum there shall be 2 cameras at the bow loading area, 1 at the port aft loading area, and 1 at the starboard aft loading area.</p> <p>Cameras shall be positioned to provide a side view of the vessel deck and the transition to the dock where passengers board and alight.</p> <p>Cameras shall be located in a manner that does not present a tripping hazard and shall be adequately protected from salt water spray to allow for capture of imagery.</p>
1	Pilothouse view of bow loading area	<p>This camera will be located at the pilothouse to show as close as possible to the captain's view of the bow during docking and passenger boarding/alighting.</p>
1	Pilothouse navigation view	<p>This shall be a color IP camera to provide the captain's forward view in navigating the vessel, aimed parallel to the centerline of the vessel.</p> <p>The selected camera shall provide capture quality that is able to capture images in daylight or with normal nighttime illumination from the pilothouse. Video samples showing camera performance will be submitted for approval by the Engineer.</p> <p>This camera shall not be displayed on the pilothouse display.</p>
3 minimum	Full passenger area	<p>There shall be minimally three passenger compartment cameras to provide complete coverage of all areas of the passenger compartment, excluding the interior of the heads. This shall include at least:</p> <p>One (1) on the Main Passenger Deck viewing the bow loading door</p> <p>One (1) on the Main Passenger Deck viewing the Port loading door and commissary</p>

Quantity	Type	Description
		<p>One (1) on the Main passenger Deck viewing the Starboard loading door and commissary</p> <p>Additional cameras shall be provided, if required, based on Contractor's camera layout.</p>
1 minimum	Pilothouse inward facing	<p>There shall be one or more pilothouse cameras to provide complete coverage of all areas of the pilothouse, including complete coverage of the instruments and controls.</p> <p>The camera shall have sufficient resolution to record crewmember actions, including whether a crewmember is physically incapacitated.</p> <p>The cameras shall be capable of using ambient light in the pilothouse, and when ambient light levels drop too low for normal operation, automatically switch to infrared or another operating mode that enables recording sufficient clarity to comply with the requirements of this section.</p>
1	Back-up camera view	<p>This shall be a single camera located aft on the vessel, showing the view astern.</p> <p>This camera shall be shown on the pilothouse display only when the vessel is moving astern and shall replace all other images with a full screen view.</p>
2	Engine rooms	This shall be a single camera in each engine room to provide a view of the engine and generator as well as much of the remaining engine room as possible.
2	Jet rooms	This shall be a single camera in each jet room showing as much of the jet room as possible.

441 RADIO

Contractor shall remove the VHF radios and shall either return to the Authority or dispose of the radio, at the Authority's option. The Contractor shall provide and install two (2) ICOM M605 (or equal) VHF radios and (2) COMROD AV 60 antennas in locations as approved by the Authority. Power shall be supplied by an emergency circuit. Also see Section 433 regarding requirements for a back-up loud hailer capability.

UHF radios and antenna shall be tested, and the radios and antennas removed by the Contractor, inventoried, securely packaged and stored for the duration of the overhaul in Contractor's weather

protected storage area. The radios shall be incorporated into the redesigned pilothouse console described in Section 646 and shall be reinstalled and rewired as part of the console installation. After completion of overhaul work, test the UHF radio system for proper operation.

446 AUTOMATIC IDENTIFICATION SYSTEM (AIS)

The existing Furuno FA-150 AIS system shall be retained. It shall be removed from the vessel after arrival at the Contractor's facility, added to the Contractor's inventory list, and securely stored in the Contractor's storage space. The AIS shall be reinstalled after completion of overhaul work that could damage the AIS, and prior to Dock Trials. The system includes a transponder, GPS antenna, VHF antenna, and digital control and display unit.

The AIS system shall be interfaced and integrated with the pilothouse navigation and communication equipment specified in Section 423. Power to all electronic navigation and communication equipment shall be supplied by an emergency power circuit.

500. PIPING, INSULATION, HVAC, FIRE SAFETY, ANCHORING & MOORING

501 PIPING SYSTEMS

Any new, replaced, or modified pipe runs shall be installed in accordance with USCG requirements and shall, as far as possible, be kept clear of work or access areas. Pipes shall be secured to structure by bolted clips and hangers. Pipe runs requiring regular maintenance shall be separated by flanges to facilitate removal. Bulkhead penetrations shall conform to USCG regulations.

Exposed pipe runs, or pipe runs located in unheated spaces shall be protected against freeze-up by heat-tape and insulation, or a Thermom, or equal, Heat Trace system. All fresh water and salt water lines shall have drain cocks installed to allow for system drainage to prevent freeze-up during winter layup or repair periods.

Newly installed piping or lagging which is exposed to view shall be color banded and stenciled for identification. Standard safety colors (approved by the Authority) shall be used to distinguish machinery, pipes and fittings, which may present a hazard.

508 INSULATION

508.1 THERMAL

Exterior boundaries of accommodation spaces shall have thermal insulation removed and replaced in-kind. Insulation fastening shall be USCG approved.

508.2 PIPING INSULATION

All existing piping insulation shall be removed and replaced with new. Where not already installed, Contractor shall also provide new insulation for:

- all cold water piping and equipment such as sanitary, fresh water, and soil pipes where dripping condensate may occur.
- Hot potable water piping and circulating systems
- Heat traced potable water and drain piping

Contractor shall propose suitable insulation in their design package, which may need to be better than the currently installed insulation. It should be noted that the insulation and freeze protection on the piping in the aft bulkhead behind the galley is currently inadequate. Those pipes are susceptible to freezing and should therefore have a more robust combination of insulation and/or heat tracing applied through the overhaul.

Prior to the installation of any insulation and/or lagging, the applicable piping installation must be inspected by the Authority for both construction, installation, and coatings. Failure to allow for this inspection may result in the requirement to remove and subsequently replace the insulation or lagging for inspection at the Contractor's expense.

All insulation and lagging installations are subject to the specific inspection and approval of the USCG and Authority, and must be in accordance with the applicable CFR requirements.

511 HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

511.1 GENERAL

Contractor shall overhaul and upgrade the HVAC system as described in the following sections. The Contractor shall submit preliminary HVAC calculations with their design proposal to show how the heating, cooling, and ventilation in the main deck passenger spaces, pilothouse, and engine rooms will be adequately designed for a climate-controlled environment. Calculations for the engine room and other below deck spaces shall include provisions for any additional or upgraded machinery required by the technical specification. Electrical loads shall be calculated to confirm adequate generator sizing.

The HVAC system modifications shall be designed and installed in accordance with SNAME Technical and Research Bulletin No. 4-16, manufacturer's recommendations, and the Specifications herein. The HVAC system as delivered shall be fully functional and shall meet the specification requirements.

511.2 HVAC CALCULATIONS

Within 30 days after Notice to Proceed, the Contractor shall provide preliminary calculations and a high level, conceptual plan for the HVAC system. Within 90 days of Notice-to-Proceed, and prior to purchasing HVAC materials, the Contractor shall submit for Authority's review and approval a complete, updated HVAC analysis and calculations as part of the complete HVAC design package for both the main passenger cabin and the pilothouse. The calculations shall demonstrate the system's ability to maintain the passenger area and pilothouse per the requirements of these specifications. They shall incorporate all applicable modifications to the vessel, including, but not limited to:

- Addition of fresh air and dampers to the ventilation system (see Section 511.4.2)
- Additional hydronic baseboard heating (see Section 511.4.1.2)
- Any changes to windows and doors
- Any modifications to insulation
- Independent heating and cooling for the wheel house
- Permanently installed defrosters for pilothouse forward windows
- Changes in machinery or equipment

511.3 ALTERNATE PERFORMANCE STANDARDS

The Authority aims to increase passenger comfort on these vessels through improvements to the HVAC system. However, it is understood that the vessel was designed with different standards and may cause limitations in the ability to achieve the desired heating and cooling performance criteria. While the Contractor is required to try to meet the HVAC performance criteria detailed in the following sections, modification of these criteria may be made during design review if the Contractor provides thorough and conclusive documentation of the following:

- The specific criterion/criteria that are unable to be met.
- The specific limitations of the vessel's design and what modifications, if any, would be available to mitigate – with justification of why such modifications would be infeasible (conceptual description of the fatal flaws) or cost prohibitive (order of magnitude cost estimates).
- Other solutions that may enhance customer comfort despite not meeting the specified performance criteria. (For example, locating heat sources closer to passenger seats to provide a warmer local environment even if the overall interior temperature is unable to reach the desired heating level)
- Provide for Authority approval, suggested alternate performance criteria to which the overhauled vessel shall be tested.

Contractor's bid shall include all minor, non-invasive modifications outside of the HVAC system that would be envisioned to allow for meeting the HVAC performance criteria. Contractor should not include major vessel modifications that would be typically be considered cost-prohibitive. For example, an upgrade such as replacing insulation with a "drop-in" replacement that has a higher R-value but does not require major changes to the design or installation would be considered a minor modification. Adding new insulation to a currently un-insulated location that would require structural modifications and a dramatic increase in design and labor costs would be a major modification. Modifications to the HVAC system directly, such as increased size of heating coils or condenser units should be included in the Contractor's bid.

511.4 MAIN CABIN

The main cabin HVAC system shall be redesigned as follows to provide an improved passenger experience:

511.4.1 MAIN CABIN HEATING

The vessels shall utilize overhead electric heat controlled by a single, solid state temperature controller using a combination of a ceiling mounted overhead heat system with diffusers and a modified version of the existing underseat hydronic system.

The heating system shall be divided into three parts:

1. Overhead Heat – The overhead heat system shall use electric heaters supplied as part of the HVAC system unit(s) to add heat to a mixture of outside fresh air (see Section 511.4.2, below) and inside recirculated air entering the vessel. The Contractor shall evaluate the appropriateness of the existing overhead units in providing adequate heating capacity. Bids shall assume a replacement of the existing overhead units with higher capacity units. The Contractor may propose a cost savings change order during design review if it is determined that the existing overhead units may reasonably be overhauled and reused while meeting the performance criteria of this specification.

Overhead heaters shall be arranged to operate in two (2) stages, with proportions to be submitted for review and acceptance by the Authority as part of the HVAC design package. The heater coil shall be located downstream from the evaporator. The coils shall have sufficient capacity to heat the total input quantity of fresh air at an ambient temperature of -10°F (-23°C) to 71°F (22°C) and shall also have sufficient capacity to heat the total quantity of mixed air from 46°F (7.8°C) to 71°F (22°C).

Overhead heat protection circuitry shall be provided to detect and automatically remove power from the control circuit and high voltage circuit(s) when an overheat condition is detected.

2. Bulkhead Heat – Contractor shall remove and replace the current underseat hydronic heat system with a newly designed system to provide convection heat throughout the main passenger cabin at the deck level to overcome bulkhead losses. This may be an electric system, or it may be a hydronic system using excess engine heat. The Contractor shall take appropriate steps in the design of the bulkhead/underseat mounted heater system to minimize overall power demand while complying with all technical requirements of this specification. Temperature of heater case surfaces that shall be encountered by passengers shall not exceed 140°F (60°C). Heater assembly and mounting shall be arranged to produce no audible vibration and to prevent loosening of components during vessel operation.

If Contractor proposes to retain some or all of the existing hydronic heat system, the existing supply piping to the heaters, as well as the existing circulation pump shall be replaced with a unit of appropriate size for the modified system. Any modifications of the hydronic system shall carefully consider related effects to the main engine and shall take all precautions to prevent the system from negatively affecting engine performance or service life.

Contractor may submit for Authority review other bulkhead or floor level heating systems that may provide comparable or better performance.

The two heads are heated by 1KW bulkhead mounted heaters. Contractor shall replace these heaters with new heaters of an Authority-approved design to meet the requirements of the HVAC calculations required by Section 511.2.

3. Protective Heaters – to prevent component or sub-component freezing per the requirements of Section 511.10.

DESIGN PARAMETERS:

The main cabin heating system shall be designed to provide an inside temperature of 70°F (21°C), with an ambient temperature of -10°F (-23°C) giving full consideration to heat losses to be expected at maximum operating speed.

511.4.2 MAIN CABIN VENTILATION

The main cabin ventilation system shall be overhauled and modified as detailed in the following sections. The ventilation system after overhaul shall maintain the required airflow and pressurization requirements while keeping generated and transmitted noise to a minimum.

FRESH AIR:

The main cabin ventilation system shall be modified to add fresh air into the passenger cabin. The Contractor shall install new fresh air intakes, located away from salt water spray and protected from rain or cleaning water.

The intakes shall be designed such that fresh air will pass through a demister (water separating) louver and a filter before entering the ducting system. Fresh air intake will be constructed of aluminum insulated flex ducting and galvanized steel. Fresh air exhaust cross ducts shall be constructed of stainless steel, shall be designed to prevent entry of water, rain or snow, and shall be sloped to drain outside of the vessel. Precipitation must not leak into the interior of the vessel, whether or not the unit is operating. The design must also prevent an accumulation of snow from blocking the airflow.

Electro-pneumatic or motor operated fresh air dampers shall be provided at each fresh air intake or in each fresh air duct to control outside air flow into the vessel.

The ventilation system shall be capable of three (3) states of operation:

- a. Shore Power – Dampers shall remain open for an adjustable length of time, starting from the time at which the vessel switches to shore power, then close for the remainder of the time on shore power. Adjustment of the time for open dampers shall be easy enough to allow for seasonal adjustment.
- b. Normal Operation – During normal operation, the system shall maximize the use of fresh air (as high as 100%) to reduce or eliminate recirculation. Operation during extreme ambient temperatures, fresh air dampers shall be automatically adjusted to achieve the interior temperature schedule however at no time shall the CO₂ levels with a full passenger load with all doors closed, do not exceed the ASHRAE limit of 1150 ppm (450 ppm for ambient air plus 700 ppm). The air conditioning blower fans shall supply a mixture of fresh air and conditioned

air thru the passenger compartment ceiling air ducts to the air diffusers. The temperature schedule and states of operation shall be proposed for review and acceptance by the Authority. Contractor's design shall specify the number of air changeouts per hour during normal operation.

- c. Maximum Ventilation – This shall be a mode that is manually selectable by the vessel crew during operation. It shall maximize the flow of fresh air and shall heat or cool to the extent feasible within the limitations of the system components provided for normal operations. The primary function of this mode is to maximize fresh air flow, with a target of 15 air changes per hour. It is understood that on high or low temperature days, this mode may not be able to provide a comfortable passenger environment. Contractor's design shall demonstrate the ambient temperature range in which the performance criteria would be able to be met in the maximum ventilation condition.

PASSENGER HEAD EXHAUST:

Air from the passenger cabin shall be exhausted from the two (2) passenger heads via screened external ducts. Supply and exhaust air ducts shall be located so that exhaust air does not recirculate back to the outside air intake and so that back-draft during high-speed vessel operation does not back feed exhaust into the heads.

Per the BOCA National Mechanical Code, a minimum of 75 cfm fresh outside air shall be supplied to the passenger heads at all times. Passenger head exhaust shall, at all operating speeds, maintain a negative pressure at all times as compared to the rest of the vessel interior. The exhaust air from the passenger heads shall be ducted having dedicated sealed ductwork and directed to the exterior of the vessel, away from fresh air intakes.

DUCTS:

The Contractor shall provide labor and material to clean the interior surfaces of ALL existing HVAC ductwork (supply and exhaust air) that is to be retained. This shall include supply and exhaust air ductwork for the passenger cabin and machinery spaces.

All ducting that cannot be adequately cleaned, including all flexible ducting, shall be removed and replaced with new, meeting the requirements of the HVAC calculations. Flexible transition ducts of low smoke neoprene-coated fiberglass, glass cloth, or compression type seals shall connect the overhead air conditioning units to the main air distribution duct. Transition ducts or compression type seals shall be fire resistant and shall be able to withstand, without damage, the maximum temperature developed by the overhead heat unit before over-temperature cut-off in the event of blower failure. All ducts, transition ducts and seals shall be USCG Approved.

AIR DIFFUSERS:

The modified ventilation system shall discharge air from the passenger area ceiling at no more than a maximum velocity of 50 fpm (0.25 m/s), when measured in a plane 48" (1219 mm) above the top of the finished deck.

AIR FILTERS:

Fresh and recirculated air shall be filtered by disposable type air filters. Filters shall be located so that they shall be readily reached and changed by removal of no more than one ceiling panel at each location. The system shall be capable of using MERV-13 or better filters.

511.4.3 MAIN CABIN AIR CONDITIONING

Although the current air conditioning compressor/condenser assembly currently utilizes R-410a refrigerant, the original system utilized R-22. The original system was a forced overhead air conditioning system designed to produce up to 10 Tons (120,000 BTU's) of cooling capacity with two 5-ton air cooled condensing units located port and starboard of the wheel house. The condensing units supplied cooling to the four air handlers located above the ceiling in the passenger cabin to cool to the passenger area and wheelhouse. Each air handler was also fitted with a 5 KW electric resistance heating coil for overhead heating. Temperature control was provided by two thermostats located close to the finished ceiling of the passenger area.

When the air conditioning system on these vessels were changed from R-22 to R410a, only minimal modifications were made to allow for operation of the system, meaning that the systems may not currently operate at maximum efficiency. Therefore, the Contractor shall not rely on the current air conditioning configuration and components in developing the modified air conditioning design.

DESIGN PARAMETERS:

The main cabin air conditioning system shall be designed to for the operating conditions specified in **Table 2**.

Table 2: Main Cabin Air Conditioning Temperature and Humidity Design Parameters

Ambient Temperature:	95°F (35°C) Dry Bulb 78°F (26°C) Wet Bulb [105°F (41°C) Dry Bulb air into condenser]
Solar Load:	42° Latitude, maximum solar heat rate
Passenger Load:	Maximum seated passengers of 110
	450 BTU/hr/passenger, at a sensible heat ratio of 0.50
Other Heat Loads:	Normal vessel lighting and other electrical loads

After all vessel and HVAC modifications, the vessel interior temperatures indicated in **Table 3** shall be maintained within the passenger area when the associated ambient temperatures are present:

Table 3: Required Interior Vessel Temperatures

Ambient	Interior Vessel Temperatures
-10°F (-23°C) to 60°F (13°C)	70°F (21°C) $\pm 2^{\circ}\text{F}$ (1°C)
60°F (13°C) to 95°F (35°C)	75°F (24°C) $\pm 2^{\circ}\text{F}$ (1°C)
Above 95°F (35°C) to 115°F (46°C)	20°F (11°C) below ambient

OUTDOOR CONDENSING UNITS (OCU):

The P&S outdoor condensing units (OCU) located on the Upper Deck forward shall be removed and scrapped. New units sized per the Contractor's HVAC calculations shall be provided and installed. Installation shall include modifications to foundations, piping, ductwork, and controls as may be required.

The new OCUs shall be interchangeable, and designed for refrigerant R-410A, unless otherwise approved by the Authority. They shall be a Certified External Marine Installation Package to prevent corrosion. HVAC unit and component design and installation shall facilitate the accessibility to perform all maintenance, trouble-shooting and repair easily and without interference with other systems. Thermostats and filters shall be removable without dismantling the assembly.

The modified main cabin air conditioning system shall be arranged for operation on ship's service power. It shall use electromechanical equipment having sufficient capacity to cool the vessels under the temperatures and other design parameters identified above.

Insulation shall be provided on refrigerant suction lines and drain lines to preclude the formation of condensate on these lines.

The air conditioning system shall include a mechanism to lock out operation of compressors at ambient temperatures below 50 degrees F.

EVAPORATORS:

Contractor shall replace the existing evaporator units with new units designed to meet the design parameters of the modified system.

OVERHEAD HEATERS:

The overhead heaters described in Section 511.4.1 Main Cabin Heating shall be replaced with new, consistent with the requirements of the HVAC calculations. The CONTRACTOR shall take appropriate steps in the design of the overhead heat system to minimize overall power demand while complying with all technical requirements of this specification.

EVAPORATOR DRAIN LINES AND DRIP PANS:

Evaporator drip pan drain lines shall be removed and replaced in-kind with new. They shall have no traps and shall be run to the exterior of the vessel in a manner that ensures adequate drainage without obstructions or areas where fluid is likely to pool. The bottom of the evaporator drip pan and drain lines shall be insulated to prevent sweating due to condensation. The evaporator drip pan and drain lines shall be designed so that the condensate will not overflow the pan when the vessel is in the worst case of lateral and/or longitudinal inclination, as well as acceleration and deceleration encountered in normal service.

REFRIGERANT PIPING:

The Contractor shall remove and replace the existing refrigerant piping with new, appropriately sized for the modified system utilizing R-410A. .

511.4.4 MAIN CABIN HVAC CONTROL SYSTEM

The main cabin HVAC control system shall be manually adjustable and controlled by a single controller with a combination of solid-state temperature sensors and microprocessor controls. The single controller shall provide for both overhead and deck heat as part of the HVAC controls. The temperature controller or sensor used to determine interior temperature shall accurately determine the average temperature of the passenger compartment. It shall be mounted and secured in a location to prevent unauthorized use. Thermostats will regulate the cycling of equipment to hold temperatures within the control temperature settings.

The system shall utilize a separate thermostat to control designated layover heaters only when the vessel is connected to shore power. In this position, the evaporator blowers shall not operate. The layover thermostat shall be located in a position to automatically maintain the passenger compartments at a temperature not lower than 50F degrees.

System functional description for in-service HVAC as well as protective heat, shall be submitted for review and acceptance by the Authority, within 60 days of NTP.

511.5 HEADS

Heat, ventilation and air conditioning, shall be provided for the passenger heads per the requirements of Section 511.2.

A ceiling mounted radiant heater shall be installed in each passenger head and shall be tied to the main cabin HVAC control system in Section 511.4.4. Protective heaters shall be removed and replaced with new per Section 511.10.

511.6 PILOT HOUSE

The existing pilothouse HVAC equipment and ducting shall be removed and replaced with a new self-contained HVAC system with thermostat control. A window mounted air conditioning unit is not acceptable. Contractor's calculations shall indicate that the new unit is capable of maintaining a comfortable operating environment in all seasons.

Contractor shall also include defrosters/defoggers for the pilothouse forward windows, which shall have controls located in the pilothouse console. The defrosters shall provide airflow to the forward windows from multiple directions.

511.7 MACHINERY SPACE VENTILATION

All fans, dampers and louvers used in the supply and exhaust ventilation trunks located in hull machinery spaces shall be replaced with commercial, marine grade, Coast Guard approved units. Contractor shall ensure that the system, after overhaul, meets all applicable USCG requirements. Engine room supply fans shall be energized automatically at engine start-up. A manual start/stop override shall be provided locally in each engine room. Engine room supply fans shall be a component of the emergency shut-down and fire suppressant release circuits as per USCG requirements.

511.8 UPPER DECK PASSENGER AREA

The infrared heater in the ceiling of the covered upper deck passenger area shall be replaced in-kind. The new heaters shall be approved by the Authority.

511.9 OTHER SPACES

Void spaces and pipe chases with freezable liquids shall be supplied with electric space heaters or heat tape and insulation, as required. Effective vents shall be installed for each space in accordance with USCG regulations, including but not limited to, hull voids.

511.10 PROTECTIVE HEATERS

Protective heaters for vessel systems and components, including, but not necessarily limited to the flushing and potable water systems, shall be removed and replaced with new. The Contractor shall utilize temperature information from the HVAC system thermostats to control these devices, or they shall contain integral thermostats. Protective heaters shall be energized when the ambient temperature at the heater drops below 40°F (4.4°C). Protective heaters shall be de-energized at 41°F (5°C) or above.

The shore powered layover heat system shall be designed to maintain the vessel at a temperature to prevent the freezing of any onboard systems during the winter season in the MBTA service area. Final temperature to be approved by the Authority.

520 SEA CHESTS & VALVES

The sea chest shall be inspected for corrosion, marine growth, leakage, wear and tear and restored to like-new condition. Individual seawater suction piping connections on the sea chest shall be removed and reconditioned. Piping and associated butterfly valves shall be replaced in kind. Butterfly valves shall be Class A.

Sea chest valves shall be replaced in-kind with new, meeting all USCG regulations. All shipboard valves, petcocks, draincocks shall be replaced with new marine grade replacements. Anodes shall be removed and replaced with new.

521 FIRE MAIN & BILGE PUMP SYSTEM

521.1 BILGE SYSTEM

521.1.1 BILGE SLOPS

All machinery space bilges including engine rooms and jet rooms shall be cleared of bilge slops and the spaces shall be made gas-free and clear for “hot work”. The Contractor shall pump and properly dispose of all water or oily water from the vessel bilges in accordance with all federal, state and local regulations. The Contractor shall allow for the removal and disposal of 200 gallons of oily water.

Loose scale and debris shall be removed from all bilge areas prior to the final cleaning for inspection. All bilges shall be final cleaned and wiped dry to facilitate the internal structure inspection.

521.1.2 BILGE SYSTEM COMPONENTS

The bilge manifold, bilge pump and all gauges, valves, suction strainers and flexible hoses shall be replaced in-kind with new. Individual bilge suctions, piping and the bilge manifolds shall be inspected for condition and tested for proper functioning, and any repairs made, if necessary. Sea strainers shall be replaced in-kind with new.

Contractor shall also modify the bilge system in each hull to incorporate a deck fitting for bilge pump out, with appropriate valves to allow crew to direct bilge water to be either pumped overboard or pumped dockside for collection.

The bilge alarms shall be replaced in-kind with new, including audible and visual digital readouts located in the pilothouse console.

521.2 FIRE MAIN SYSTEM

The Fire Main pump and all gauges, valves, through hulls and hoses shall be replaced in-kind with new.

The system shall be functionally tested to provide the flow and pressure required by USCG regulations. The fire pump shall have local and pilothouse on/off control.

Fire hose storage in the main deck shall be reconditioned, including replacement of the door to incorporate with the new interior wall panels, marked visibly meeting all USCG requirements. Fire hose shall be replaced with new.

526 SCUPPERS AND DECK DRAINS

526.1 GENERAL

The Contractor shall inspect, clean and repair all scuppers, limber holes, drains and drain pipes to a like-new condition.

526.2 LOADING AREA DRAIN PANS

New recessed drain pans shall be provided and installed just inside of all exterior doors per Section 634.4. The pans shall be fitted with deck drains, such that when a mat is rolled back or removed, the pan can be flushed down with water.

The drain pans shall be piped consistent with the requirements for operation of the vessel under an EPA Vessel General Permit (VGP).

526.3 DECK DRAINS

Interior and exterior deck drains shall be removed and replaced in-kind, including all piping and surface covers/grates. Deck drain piping shall have no less than 1/8" slope per foot in longitudinal runs and 1/4" per foot in transverse runs.

All deck drains shall be piped consistent with the requirements for operation of the vessel under an EPA Vessel General Permit (VGP).

528 SANITARY SYSTEM

All "Black" and "Gray" water piping and associated components shall be piped consistent with the requirements for operation of the vessel under an EPA Vessel General Permit (VGP). All drains leading to the CHT shall be equipped and installed with traps arranged so that the trap water, which eliminates the back-flow of CHT tank odors, will not be sucked out of the trap upon suctioning off of the CHT tank by the shore side pump.

The existing piping for the sea water toilet flushing system shall be removed, and the Contractor shall convert the passenger toilet flushing system to a fresh water system utilizing marine heads, Headhunter brand or similar. The onboard potable water capacity shall be increased to accommodate this conversion, per the requirements of Section 123.1. All necessary valves shall be incorporated into the system to prevent accidental introduction of water from the sanitary system into the potable water tank.

The Contractor shall remove the existing head sewage drain lines and replace with CuNi lines.

The Contractor shall remove the existing sink drain piping from the heads and commissary and replace with new. To the extent allowed by USCG regulations, PVC and CPVC piping will be used.

533 POTABLE WATER SYSTEM

The complete potable water system shall be removed and replaced with new, including hot and cold water to vanities in each passenger head and commissary sinks, and cold water to commissary equipment and toilets, as required. All parts shall be replaced in-kind, unless otherwise dictated by the specified system modifications. To the extent allowed by USCG regulations, PVC and CPVC piping may be used. The replaced potable water system shall consist of the potable water tank specified in Section 123.1 and pressure set including primary filter, pump, accumulator tank, pressure gage, valves, and associated piping and fittings.

Contractor shall remove and scrap the existing water heater and replace with a new 4-gallon electric water heater, BOSCH or approved equal. The main deck 1½ inch fill station with cam lock fitting shall be replaced with new. A secondary filter shall be provided and installed in the commissary area for the sink and equipment, and all interior fixtures shall be replaced with new.

The ADA passenger head sinks' hot water and cold water supply lines shall be arranged with inline valves; ¾" garden hose fittings; and fitted with short lengths of hose for filling mop buckets. This valve and piping arrangement shall be installed to be as operationally accessible as possible for crew use in filling deck washing buckets.

555 FIRE EXTINGUISHING

555.1 GENERAL SCOPE

The vessel's portable fire extinguishing equipment shall be removed and suitably stored for the duration of the overhaul. Each removed extinguisher shall be tagged as to location prior to removal. The vessel's fire extinguishers shall not be used for fire watch. The Contractor shall provide yard extinguishers for fire watches during the Contract period. The Contractor shall reinstall the vessel's extinguishers with new hangers mounted to structure or to stand-offs attached to structure on station prior to Dock Trials.

The Fire Main system is addressed in Section 521.

555.2 FIXED SYSTEM

The existing USCG approved Fireboy-Xintex Clean Agent FE-241 engine room fire suppression system shall be inspected and tested by an OEM certified fire suppression system inspection company to the approval of the attending USCG Inspector.

The Contractor shall provide and install a new, Automatic Engine Shutdown System with automatic discharge alarm. The existing fire suppression system has pressure switches that provide shut downs to various machinery, fans, and louvers upon release of suppression agent. These shall be disconnected in the process of system removals. The Fireboy-Xintex system pressure switches shall be connected to existing shut down cabling for the main engines,

starboard SSDG, and ventilation fans (2 supply and 2 exhaust). A new shut down shall be installed and connected to the shutdown system for the new port SSDG, replicating the same system arrangement as on the starboard SSDG.

555.3 PORTABLE EQUIPMENT

Upon delivery of the vessel to the Contractor's shipyard, the Contractor shall remove all vessel fire extinguishers and portable firefighting equipment to an off-the-vessel weather-protected secure storage location. The Contractor will provide adequate fire suppression and extinguishing coverage for the time between delivery and sea trials for all vessel spaces. Emphasis shall be placed on having adequate extinguisher capacity in any area where hot work is being performed.

The Contractor shall engage a certified Fire Extinguishing firm, to inspect and date tag all extinguishers prior to the completion of the Contract and delivery of the vessel back to the Authority. Prior to Dock Trials, the Contractor shall replace removed equipment in their stations.

Extinguisher brackets that have been removed during Contract modifications shall be replaced. Any bracket on a soft-core joiner bulkhead shall be attached to a stand-off to structure. All installations shall be approved by the attending USCG Inspector and Authority.

568 STEERING CONTROL SYSTEM

The Contractor shall remove the existing steering control system and provide and install a new system that is compatible with the MJP waterjets – steering control shall be Vector Controls, or equal. Contractor shall be responsible for all other upgrades related to the installation and operation of the new steering control system, as recommended by the steering control manufacturer/Technical Representative. Steering shall be controlled from the pilothouse console as well as an additional hand held, wander lead station that is compatible with the steering control system. Contractor shall provide a wander lead that is long enough for operation of the vessel from the P&S outside decks adjacent to the pilothouse doors. The steering station shall incorporate steering angle indicators for each waterjet to be located as per the approval of the Authority.

The maneuvering and thruster steering control system shall be a complete operating system together with the waterjet components described in Section 246. The system shall be fully redundant with automatic switchover to the standby system in the event of a failure of any sensor (joystick, tiller, feedback, etc.) or control unit. Backup steering controls shall be incorporated. Contractor shall be responsible for any modifications required to integrate the waterjets with the new control system.

All hydraulic piping associated with the waterjets, including actuators, tubing, hoses, valves, couplings, etc. shall be replaced with new to bring the system to a like-new condition. Hydraulic tubing will be seamless, drawn stainless steel tubing. Valves and other metallic components and hardware shall be CRES.

Hydraulic Power Units (HPUs) shall be inspected and serviced. Contractor shall replace the hydraulic pump in each jet room in-kind with new. Solenoid valves shall be replaced with new, meeting any associated requirements for the new steering control system. Damaged or worn parts shall be replaced with in-kind with new. Obsolete parts shall be upgraded to new. The hydraulic tanks shall be drained, stripped, cleaned and inspected and brought to a like-new condition, including replacement of filters and other parts, as required. Contractor shall be responsible for refilling with oil and correctly adjusting pressure settings.

Waterjet components shall be permanently marked with a code so that change outs and service life can be tracked.

581 ANCHOR HANDLING AND STOWAGE

The Contractor shall modify the existing anchor stowage rack to also secure the anchor shank. The anchor shall be retained, but Contractor shall replace the anchor line, chain and hardware with the following:

- (250 feet) Anchor line: 1- inch diameter, poly-Dacron, 18,750# tensile strength; eye splice and stainless thimble in both ends. The bitter end shall be shackled to a dedicated hold-fast eye welded to the vessel's structure in one forepeak. The outboard end shall be shackled to chain.
- (15 feet) Chain: stainless steel, $\frac{1}{2}$ inch diameter links
- (1 set) Shackles and swivel: stainless steel, as required

582 MOORING SYSTEM

The mooring cleats and chocks shall be inspected and repaired as required.

The Contractor shall store the vessel's mooring lines for the duration of the shipyard Contract period in a secure deck area, as approved by the Authority. The vessel's mooring lines shall be replaced by shipyard-supplied lines for the duration of the overhaul work to prevent damage or loss during blasting, coating, and other repair work. Upon completion of overhaul work, and prior to delivery back to the Authority, the vessel's mooring lines shall be returned to their original locations on the vessel.

600. OUTFITTING & MARKINGS

602 SIGNAGE & MARKINGS

602.1 GENERAL

The Contractor shall thoroughly remove all existing signage and markings and provide and install all USCG required internal and external signage and markings. Access/Braille signage shall comply with 521 CMR 41.00 and the PVAG. The Contractor shall provide and install additional signage, as required by these Specifications. The Contractor shall submit to the Authority for review and approval, a drawing package identifying the location of all signage to be installed on the vessel.

602.2 REGULATORY HULL MARKINGS

The following letters and numbers will be painted in contrasting color, sized in accordance with USCG regulations 46 CFR and positioned to the approval of the Authority per the approved exterior styling scheme (see Section 631.5):

1. Vessel Name: Port and Starboard bows, transom, pilothouse top
2. Hailing Port: transom under name
3. Draft marks: Outboard hulls, forward and aft, P&S (4 sets)

The Official Number shall be inspected, and if necessary, renewed to ensure legibility for the remaining life of the vessel, in accordance with 46 CFR.

602.3 LOGOS

The following will be applied in UV-protected vinyl decal material located to the approval of the Authority, per the approved painting and styling scheme, per Section 631.5:

1. Authority's logo, in approved locations
2. MassDOT logo, in approved locations

The Authority will supply Contractor with logos in electronic graphic form. Logo(s) of the Authority's contracted operator shall not be applied or included in the styling scheme.

602.4 BUILDER'S PLAQUE

An engraved, bronze builder's plaque will be provided and installed on the main cabin's forward bulkhead below the original builder's plaque. At a minimum, the builder's plaque shall identify the vessel name, overhauling shipyard, owner, and re-launch date. The builder's plaque wording shall be approved by the Authority prior to the plaque being ordered.

602.5 AUTHORITY'S STANDARD SIGNAGE

Contractor shall remove the signage installed in the vessels and shall provide and install all required signage, including signage required by the USCG, ADA/PVAG, and other regulatory bodies. Contractor shall also provide and install those required for sanitary purposes in the commissary and restrooms, and other MBTA standard signage.

Signage should be expected to include, but not be limited to:

- Signs that designate permanent rooms and spaces, these include toilet room signs, room numbers, stair signs, etc.
- Signs that provide direction to, or information about, functional spaces
- Accessible passenger loading zones
- Upper deck directional signage to passenger heads
- Main deck directional signage to upper deck passenger seating
- Priority seating and companion seating
- Electrically lighted exit signs at all exits
- Main & upper deck directional signs for emergency debarkation
- “Crew only” designation signage on crew access doors, service lockers, and newly installed barrier swing gates on the upper forward weather deck (see Section 623)
- Safety signage to direct passengers to stay off of stairs while docking, and no access to bow underway.
- No smoking signage
- Notification that CCTV is in use (English and Spanish)
- CFR required safety signage
- ADA signage at passenger heads

All signage shall be installed within the criteria for height and location specified by USCG, ADA/PVAG and 521 CMR 41.00.

To the extent possible, signage shall replicate the signage on the Authority's other vessels – M/V Champion and M/V Glory.

602.6 LOW LEVEL EXIT PATH MARKING (LLEPM)

Contractor shall provide High Performance Photoluminescent (HPPL) or self-powered indicators and other emergency signage and markings to designate paths to and operation of emergency exits. HPPL is preferred over self-powered indicators, except where HPPL cannot be used effectively.

Marking shall meet the intent of APTA PR-PS-S-002-098, Rev. 3 and APTA PR-PS-S-004-99, Rev. 2. These standards are intended for railcars, but the Contractor shall develop and install a signage package that meets the intent of those standards in a manner applicable to the marine environment and tailored to the overhauled M/V Lightning and M/V Flying Cloud. This is expected to include, but not be limited to:

- Door Emergency Exit sign markings for bow loading doors, port & starboard side loading doors, pilothouse doors (per APTA PR-RP-S-002-098, Section 5.1.1.1).
- Door locator signs (per APTA PR-RP-S-002-098, Section 5.1.1.2 and APTA PR-RP-S-004-099, Section 5.1.1.1)
- Door handle markings (per APTA PR-RP-S-002-098, Section 5.1.1.3).
- Door operation instructions (per APTA PR-RP-S-002-098, Section 5.1.1.4).
- Door Delineators (per APTA PR-RP-S-004-099, Section 5.1.1.2)
- Floor level marking of all exit paths (per APTA PR-RP-S-004-099, Section 5.1.2)
- HPPL Signage on emergency equipment – IBAs, PFDs, fire hoses, etc.

Luminance and illumination levels shall be tested and verified to meet APTA PR-RP-S-004-099, Section 5.2.2 as tested per APTA PR-RP-S-004-099, Section 6.

602.7 LABELS

The Contractor shall remove existing labeling and install new labels for all electrical lines and connections, switches and breakers, valves, and piping on the vessel's interior and exterior items. Contractor shall also provide and install warning plates indicating possible hazards due to improper operation or servicing.

Nominal size of electric cabinet nameplates shall be 1 ½" x 5". Equipment nameplates shall be 1" x 3". All control devices (rheostats, circuit breakers, etc.) shall be properly marked. Cabinets, panel boards, and conductors (where required) shall be properly marked. All relocated or added equipment shall have labels affixed to wiring close to the unit identifying panel board and circuit to which it runs.

Labels shall also be provided for all piping, valves, gauges, controls, and equipment.

Labels shall be of engraved metal or high-quality plastic, durable in the environment in which they are installed, and shall be Authority approved.

602.8 FIRE SAFETY & EVACUATION PLAN

The Contractor shall supply two (2) "D-sized" copies of the Fire Safety & Evacuation Plan(s) showing the vessel as complete at the conclusion of its Overhaul, for mounting on board the vessel in locations approved by the Authority (Pilothouse and Main Deck passenger cabin).

The Contractor shall provide and install suitable, secured glass enclosed cabinets with mountings for this purpose.

611 HULL FITTINGS

The Contractor shall be responsible to provide ADA/PVAG compliant doors and sills, including thresholds as detailed in the most recent revision of the PVAG (V404.2.5). Door sill ramping shall be aluminum safety plate with side slope anti-trip plates. Ramps shall be attached to structure with bolted tabs for convenient maintenance removal. All doors shall comply with ADA requirements including the door force requirements of V404.2.9.

The Contractor is responsible for removing existing doors and frames for installation of the new doors and frames. If the new doors differ in size from the existing doors, the Contractor is responsible for any trimming or filling that may be required. It is essential that the Contractor install all doors true without twisting or bending frames to fit structure alignments. The Contractor is to deliver the vessel with doors and door hardware performance tested to the approval of the Authority and the attending USCG Inspector.

611.1 DOORS, EXTERIOR WEATHER-TIGHT

The Contractor shall replace all exterior weather-tight doors and frames. These include the bow loading doors to the forward deck, port and starboard sliding doors leading to the side embarkation/debarkation gates, stairwells to the upper deck, and access door in the aft transverse bulkhead of the main deckhouse to access the exterior deck aft and jet rooms. Also, the Contractor shall replace with new, both port and starboard pilothouse doors.

Exterior, aluminum, marine grade, weather-tight doors shall be provided that meet 46 CFR Subchapter "T" requirements. Doors shall be of North American manufacture Fabtek, Freeman Marine, Dean Steel, or equal. Exterior doors shall be fitted with lights (windows), ADA threshold "ramps", and closures (as appropriate). Door frames shall be filled with insulation of the same type and rating as the door. Doors shall be "bolt-in" frame type. All doors shall be aluminum, as appropriate for the installation, and as approved by the Authority.

1. Passenger loading doors on the bow shall be hinged, ADA accessible, and fitted with dogs and lever handle latches. Passenger doors shall be ADA accessible including sills, opening force, lever hardware, thirty-six (36) inch width and approach arrangements, per PVAG Section V206 and other applicable sections. It is understood that some doors will always be operated by a crew member and must be fitted with dogs to retain weathertight integrity while the vessel is underway. ADA sill ramp requirements shall be strictly adhered to.
2. The P&S aft weathertight doors shall be sliding or hinged per the Contractor's proposal. ADA passenger gates and doors shall be ADA accessible including sills, opening force, lever hardware, thirty-six (36) inch width and approach arrangements, per PVAG Section V206 and other applicable sections. They shall be ADA accessible (PVAG Section V206 and Technical Specification Section 0.4.4).

3. The P&S pilothouse doors shall be hinged on the forward side and fitted with dogs. The pilothouse doors shall be fitted with touchpad combination security locks and equipped with a means of securing the doors open for use of the wander lead control specified in Section 568 from P&S decks.
4. Crew door/hatch from Commissary to catwalk aft of the main deck passenger area shall be replaced with new, weathertight, hinged with dogs. The windows shall be fabricated and provided by a US manufacturer with quality at least comparable to Fabtek, Freeman Marine, Dean Steel, or equal. The new window should retain a clear opening of similar size to the original and must meet the applicable requirements of 46 CFR 177, Means of Escape. The Contractor is encouraged to propose modifications that would provide easier access from the commissary to the catwalk.

Contractor shall be responsible for any minor modifications to existing door frames to repair wasted material on perimeters, sills, etc.; infill plate; or trim plate to fit new frames.

611.2 DOORS, INTERIOR JOINER

Interior joiner doors and frames shall be removed and replaced with commercial, marine-grade, aluminum, high quality, and fitted with appropriate hardware for the intended purpose. Joiner doors shall meet the 46 CFR Subchapter "T" requirements. Doors shall be of North American manufacture FabTek, Dean Steel, or equal.

Passenger head doors shall be replaced with new and fitted with lever hardware, sliding deadbolts; occupied/unoccupied position indicators; and louvers for ventilation. Head door hardware and deadbolts shall provide at least eighteen (18) inch clear space on the latch side, require no more than five (5) pounds force to operate and be operable with a closed fist.

The Contractor's design proposed for the modification of one head to ADA compliance will predicate the type, access handles, and dimensions of that door. Both passenger heads' doors shall be ADA accessible including sills, opening force, and hardware. The door for the ADA head shall have a minimum thirty-six (36) inch width and shall incorporate approach arrangements, per PVAG Section V206 and other applicable sections.

Contractor shall be responsible for any minor modifications to existing door frames to repair wasted material on perimeters, sills, etc.; infill plate; or trim plate to fit new frames.

611.3 BITTS, CHOCKS, & FAIRLEADS

Bitts, chocks and fairleads shall be inspected, and if required, repaired and restored to as-new condition. Contractor shall pay particular attention to providing smooth surfaces where lines could chafe.

Marine quality fiberglass or aluminum boxes with lids and stainless hardware mounted on aluminum foundations shall be provided and installed one forward and one aft P&S (2 total each vessel) for the stowage of mooring lines. Boxes shall be sized each to accommodate three (3) x 50-foot long, 1 $\frac{1}{4}$ inch diameter lines.

612 RAILS & STANCHIONS

The Contractor shall inspect and repair any damaged handrail, stanchion, or back stay, including the bow deck gate. All rails and handholds shall be confirmed to be compliant with ADA/PVAG requirements. The Contractor shall use schedule 40 aluminum piping for all repairs. Railings shall be repaired or replaced, as necessary, cleaned and all areas smoothed to prevent passenger injury.

621 NON-STRUCTURAL BULKHEADS

Contractor shall remove and replace all non-structural bulkhead panels with Authority-approved equal. Surface material, color, and pattern on the exposed side(s) are to be to the approval of the Authority. If joiner panels are proposed for wet spaces (passenger heads in particular) they shall have stainless sheathing on the wet space side.

Bulkhead liners shall be proposed as aluminum sheathing with laminate facing on the visible side, or Authority-approved equal.

622 DECK PLATES, GUARDS, & LIFTING GEAR

622.1 DECK PLATES

The Contractor shall provide and install new aluminum deck plate on the exterior aft deck/catwalk around the jet room access hatches and connecting the port and starboard pontoons. Contractor shall propose a durable material that is slip-resistant material or covered with a slip resistant coating.

622.2 GUARDS

All Guards that are installed on exposed shafting, other rotating machinery, and exposed hot pipes as appropriate to protect personnel shall be inspected and replaced if damaged.

623 LADDERS, STAIRS, & GATES

623.1 VERTICAL LADDERS

The Contractor shall inspect all vertical ladders and handholds that access engine rooms, jet rooms (aft peaks), forepeak, and all void spaces. Attachment hardware shall be replaced with new, and any welds shall be inspected and repaired as required. Contractor shall replace all non-skid material on each ladder rung and on landing platforms at the base of ladders. Ladders shall comply with all applicable USCG regulations to the satisfaction of the OCMI, and if applicable, any applicable ADA regulations.

623.2 STAIRS

The Contractor shall clean all exterior stair towers from the main deck to the upper deck. All old non-skid material shall be removed from each stair tread and replaced with new. The Contractor shall install new commercial grade, aluminum non-skid safety treads, black tread, yellow photoluminescent nosing, suitable for the commercial marine operating environment.

The Contractor shall also replace all stairwell signage with new per Section 602.5 and shall install individual step lights per the requirements of Section 331.12.

Stairs and railings shall comply with USCG and ADA regulations (note regulations for rail extensions). The Authority and Contractor shall ship check and confirm this requirement.

623.3 GATES

The Contractor shall bring the bow loading gates to a like new condition and shall provide new side loading gates and upper deck crew access gates as described below.

623.3.1 BOW LOADING GATE

The Contractor shall overhaul the existing double aluminum hinged bow gates at the bow loading station. Weld shall be inspected and repaired as required. Any bent or damaged aluminum shall be repaired or replaced to an as-new condition. The hinges shall be replaced with new. The locking pin latch at the bottom, and the sliding securement at the top shall be inspected, and if required, repaired. Positive holdbacks shall be installed to secure the gates in the open position.

The complete gate assembly shall be cleaned to an as-new condition.

623.3.2 AFT SIDE LOADING GATES

The Contractor remove the existing aluminum bulwark gates aft P&S for side loading access. Contractor shall design, provide and install new gates that operate in a sliding motion, rather than the current inward swing; this will provide a clear space for the emergency engine room escape hatch required by Section 167.1. The gates shall slide easily with nylon rollers mounted on stainless axles, or other approved arrangement. A bolt pin latch (with locking capability) shall be installed on each gate.

623.3.3 UPPER DECK PORT & STARBOARD CREW AREA GATES

The Contractor shall design, provide and install new gates to be installed on the upper deck to restrict passengers from accessing the forward areas, port & starboard, next to the pilothouse entrance/exit doors. The proposed swing gate shall be constructed of marine grade aluminum, be hinged at one end for access, and have the means to be secured in both the open and closed position. The proposed gate shall be approved by the Authority prior to fabrication and installation. Appropriate signage shall be provided on the gate to indicate that access beyond the gate is for crew only.

625 WINDOWS

625.1 WINDOW REMOVALS

The Contractor shall remove all Main Deck and pilothouse windows and window frames and replace in-kind. The Contractor is responsible for preparing the aluminum surrounding the window cutouts for the proper installation of new windows. This shall include hand brushing,

commercial blast, and material replacement as required by the condition of existing plate and as determined when the existing windows have been removed. The Contractor shall accomplish repairs to plate surrounding window installations sufficient for the new installations and to meet the window manufacturer's recommendations and specifications.

Window cutout dimensions where existing windows are to be replaced may be critical to the dimension requirements detailed by the window vendor. The Contractor is responsible for any window cutout size modifications such as grinding for proper new window fit or modifying radius corners to accommodate the new windows.

625.2 PILOTHOUSE WINDOWS

The forward pilothouse windows shall be replaced with new, clear, tempered, high quality, commercial marine grade, and US Coast Guard approved glass. The side windows shall be removed and replaced with new sliding windows with suitable protection to prevent water ingress at the bottom of the window when opened. Pilothouse aft facing windows shall be removed and replaced in-kind. Any corrosion or damage to the superstructure surrounding the windows shall be repaired prior to installation of the new windows.

See Section 511.6 regarding window defrosters/defoggers.

The Contractor shall replace the windshield wipers with new heavy-duty, commercial grade, marine window wipers with local reservoir washers on each of the forward-facing pilothouse windows. Wiper fluid nozzles shall be positioned such that all areas within the reach of the wipers can be effectively cleaned. Individual console-mounted switches shall control ON / OFF / WASH / INTERMITTENT functions. A minimum 2-gallon washer fluid reservoir with tubing and connections will be installed. The Contractor shall provide and install commercial grade marine Mylar solar shades with constant tension cord locks for the forward-facing and side facing pilothouse windows. The rear facing pilothouse windows shall be outfitted with commercial grade marine blackout shades with constant tension cord locks to block the light from the passenger seating area during night operations.

625.3 MAIN DECK WINDOWS

Contractor shall remove and replace in-kind all main deck passenger windows. Replacement window manufacturer and design details shall be submitted to the Authority for review and approval prior to purchase. The new main deck passenger windows may be tinted, in which case the level of tint shall be submitted to the Authority for review and approval.

The window frames are to be aluminum, fully welded, and clear coat anodized and fitted with a continuous interior clamp ring to suit the bulkhead thickness. The Contractor shall install the windows as dual-seal silicone insulated units bedded. Window frames shall be bedded with 3-M Weatherban under the mounting flange and root sealed with Sika 295, or approved equal, from the interior prior to mounting the clamp ring.

If the Contractor's proposed modification of one head to ADA/PVAG compliance enlarges the head to encompass one of the aft windows, the window shall be replaced with frosted glass, and shall remain fixed, not able to be opened.

631 PAINTING

631.1 COATING REMOVAL

Contractor shall submit a plan for removal of paint and non-skid coatings for Authority review and approval. The Contractor shall remove all paint from all exterior hull surfaces, the vessel's superstructure, and all non-skid material from all the weather decks. Removals shall bring the surfaces down to bare fiberglass or aluminum, as applicable, and Contractor shall ensure all surfaces are prepared for accepting new coatings per the paint manufacturer's instructions. All welds from removed equipment shall be ground smooth. The Contractor shall repair or recoat any areas damaged during the removal of paint or coatings.

Where blasting and/or grinding is performed, the Contractor shall mask or seal off sea valves, machinery, equipment and all openings as necessary to prevent damage. Windows, doors, antennas, wires, A/C units, battery boxes, cables, deck lights, navigation lights, etc. shall be properly protected and sealed. Care shall be taken to schedule construction so that blasting and grinding does not occur over or adjacent to work in progress on machinery or mechanical equipment. If any of the gel coat is compromised below the waterline an epoxy conformal barrier coating must be applied to seal the hull. Any equipment damaged by blasting and coating (including overspray) shall be repaired at the Contractor's expense.

Coatings are not to be thinned with solvent for spray painting or other purposes unless specifically recommended and approved by the paint manufacturer.

Where necessary, scuppers, and overboard drains shall be sealed, plugged, or led clear overboard so that the hull will remain dry during the paint application. The Contractor shall keep a coating **Weather Log** and a **DFT Mil Reading Log**. These logs shall be available for inspection by the Authority during job progress. A copy shall be presented to the Authority and to the Paint Manufacturer's Tech Rep prior to delivery of the vessel to the Authority.

All fixtures, deck coverings, joiner work, machinery, equipment, label plates, gages, instruments, etc. shall be protected during coating operations. Upon completion of work, all paint, smudges, sealant, bonding agents, etc. shall be removed from finish surfaces.

631.2 GENERAL

From keel to waterline the hull shall be stripped to bare fiberglass gelcoat, the method of stripping to be submitted to the Authority for review. Any break in the gelcoat shall be filled with an epoxy filler and faired, and a minimum of two coats of epoxy primer shall be applied. The contractor shall provide and apply a minimum of 3 coats of a compatible high quality, commercial, multi-season anti fouling paint below the waterline. All primer and anti-fouling paint shall be suitable for high speed catamaran operation.

The Contractor shall provide and apply a commercial grade paint system for hull surfaces above the waterline. Paint performance, including but not limited to anti-fouling performance, shall be fully warranted by the Contractor. All coatings shall be commercial, marine grade, suitable for the service environment.

Prior to the commencement of coating or painting, the Contractor shall provide the Authority, for approval, a detailed coating schedule for surface preparation and application. This schedule shall be in compliance with the paint manufacturer's application and warranty requirements.

Contractor shall remove or protect all sea chest strainer plates/gratings, bearings, propulsion shafting, bearing journals, jet components, and grounding plates to ensure that no damage results from cleaning and painting operations.

An exterior paint system above the waterline, where applied, shall consist of two prime coats and at least one finish coat. Unsightly welds will be ground smooth, and surfaces to be coated shall be cleaned of residue with an approved solvent. All surface preparation and painting shall meet the requirements of the paint system manufacturer, including temperature and humidity requirements, dry film thickness, and curing time between coats.

All coating applications shall be to the approval of the Authority and shall be free from sags and runs and shall provide a uniform appearance.

631.3 EXTERIOR

All colors, up to three (3) shall be applied per the approved coating and styling guide (See Section 631.5). Finish coatings shall be installed as follows:

1. **Keels to Waterlines:** Hulls and appurtenances shall be repainted per the requirements of Section 631.2. Finish coat(s) shall be a high-quality marine, antifouling coating. The Contractor shall provide the Authority with the manufacturer's coating procedure and performance specifications for approval.
2. **Hulls above Waterline:** Outboard sides: Paint – two prime coats and finish coat (single color finish coat and up to 2 trim colors); or optional vinyl covering (as approved). Inboard sides: Painted two prime coats and finish coat; or optional vinyl covering at a minimum where visible from typical viewing angles above water line.
3. **Hull Wet Deck:** no coatings
4. **Sheer Guard:** no coatings
5. **Superstructure:** Paint, single color with two trim colors approved by the Authority.
6. **Windows:** Window band trim: paint or vinyl
7. **Decks Exterior:** Gray, non-skid, Rhino Liner, Durabak, or Authority-approved, spray-on

8. **Bulwarks:** outer sides single color to match superstructure paint or vinyl, inside bulwarks no paint

631.4 INTERIOR

1. **Bulkheads Concealed:** Behind linings – no paint
2. **Bulkheads Exposed:** Color to Authority's approval per Section 631.5
3. **Passenger Head Decks:** Passenger head decking shall be coated with gray, non-skid, Rhino Liner, Durabak, or Authority-approved, spray-on, with color per the Authority Approved interior painting and styling scheme (see Section 631.5)
4. **Pilothouse:** color to Authority's approval per Section 631.5
5. **Hull Voids:** thoroughly clean.
6. **Engine Rooms, Jet Rooms:** clean, inspect, repair as required, prepare for repainting per the manufacturer's instructions and repaint in white epoxy paint. Paint system to be submitted for Authority review.
7. **Fuel Oil Tanks:** no paint

Colors and textures shall be approved by the Authority and shall be chosen to coordinate with final interior finishes.

631.5 PAINTING AND STYLING SCHEMES

The interior and exterior painting and styling of the vessels after overhaul shall as far as possible, replicate the appearance of the Authority's vessels Champion & Glory. The Authority will provide colors and logos to the successful bidder. Within 180 days of NTP, Contractor shall submit to the Authority for review:

1. One (1) exterior coating and styling scheme **[CDRL 631-1]**
2. One (1) interior coating and styling scheme **[CDRL 631-2]**
3. Three (3) sets of paint samples **[CDRL 631-3]**.

The painting schemes shall be submitted as renderings in sufficient quality and detail to represent the proposed appearance of the vessel. Renderings shall be submitted electronically, in PDF format, or another format accepted by the Authority.

633 CATHODIC PROTECTION

The Contractor shall replace all zinc anodes in-kind with new.

The Contractor shall use new Nylock 316 stainless steel nuts, or Authority approved equal to secure the anodes in place. The Contractor shall also ensure that where applicable, all paint is

completely removed from the mounting surfaces to provide proper conductivity between the anode and the vessel's component. The Contractor shall test each installed anode for proper continuity prior to launching. External grounding plates and associated hardware shall be refurbished to like new condition.

Anodes shall be provided with sufficient capacity to provide 12-months minimum protection at all locations where applied. The Contractor shall provide details of anode materials, and installation on the as-built Docking Plan, including those contained within major components.

634 INTERIOR DECK COVERINGS

634.1 MAIN DECK PASSENGER CABIN

The Contractor shall remove all existing carpet in the main deck cabin and prep the area for all new carpet. New carpet shall be flocked textile floor covering (sheet goods), Flotex (Forbo Mfg.), or equal. The main deck passenger cabin sub-flooring deck shall be inspected for any damage, and repairs shall be performed per the requirements of Section 130 prior to any new decking installation. Floor covering shall be installed turned up 4 inches on the bulkheads. Color and pattern shall be approved by the Authority per the approved painting and styling scheme (see Section 631.5) prior to installment.

634.2 PASSENGER HEADS

The Contractor shall remove all existing floor covering/coating in both the port and starboard side passenger heads and prep the areas for application of a non-skid coating per Section 631.4. This shall include all additional area added to the ADA head.

634.3 COMMISSARY

The Contractor shall remove all existing floor covering/coating in the Commissary area and prep the areas for all new floor coverings. The new flooring material shall be a heavy duty, commercial grade, slip-resistant vinyl flooring, suitable for the intended use and environment. The flooring shall be of a type that will retain its slip-resistant properties throughout its service life. Edges shall be sealed to prevent water intrusion at the edges.

634.4 ENTRANCE MATTING

The Contractor shall provide and install new recessed floor matting with drain pans, located just inside of the forward doors bow doors per Section 526.2. The drain pan and door threshold shall be designed and installed in strict compliance with PVAG/ADA requirements.

The floor matting shall have an aluminum extruded base and securely attached, non-slip treads, suitable for the wet, high-traffic area in which they are installed. Contractor shall ensure that there are no gaps between the drain pan and matting that could create a tripping hazard. Material and color shall be to the approval of the Authority. The matting shall be placed in the drain pans so that the top matting surfaces are flush with adjacent flooring to eliminate any tripping hazards. The matting shall be readily removable for daily cleaning.

634.5 PILOTHOUSE INTERIOR

The Contractor shall remove all existing floor coverings from the pilothouse deck and prep the areas for all new floor coverings. Sub-flooring deck shall be inspected for any damage and repaired as required Per Section 130 prior to any new floor covering installation. The pilothouse deck shall be covered with flocked textile floor covering (sheet goods), Flotex (Forbo Mfg), or equal. Floor covering will be installed turned up 4 inches on the bulkheads. Color and pattern to be approved by the Authority per Section 631.5.

634.6 SAFETY MATTING

Contractor shall provide new heavy-duty rubber safety matting for the switchboard per USCG requirements.

644 PASSENGER HEADS

There are two (2) unisex passenger heads located on the main deck, with direct access from the main cabin. Contractor shall modify one head to be ADA accessible in strict compliance with the latest revision of the PVAG (Section V213) and DOT Regulation for Transportation Services (49 CFR Part 37, §37.9 and Subpart C). This shall include, but not be limited to doorways, turning radii, clear floor space, and all fixtures and features. The existing fixtures, including toilets, sinks, faucets, mirrors, towel dispensers, etc. in both heads shall be removed and replaced with new. The door swings and ADA turning radius shall be carefully designed.

The Contractor shall take particular care in determining horizontal and vertical locations for ADA compliance when installing grab rails, toilets, lavatories, mirrors, paper holders, etc. All sanitary fixture locations must be approved by the Authority.

Contractor shall remove the existing ceiling panels and associated hangers and hardware. Contractor shall replace the ceiling with a new “snap-in” 2’x 2’ (600 mm x 600 mm) panel ceiling, with recessed LED lighting (see Section 331). Ceiling tiles shall be Dampa AL-15 600 mm x 600 mm beveled edge in Pure White 4747-2, or Authority approved equal.

Interior bulkhead linings shall be removed and replaced with 25mm joiner panels, or Authority-approved equal, with fire rated finish, APL plastic covered aluminum sheathing as proposed by the Contractor and USCG approved with finishes and colors approved by the Authority.

The following ADA compliant fixtures shall be provided and installed in both heads, in accordance with the latest revision of the PVAG (Section V213) and DOT Regulation for Transportation Services (49 CFR Part 37, specifically §37.9 and Subpart C). Where possible, ADA accessible fixtures shall also be used in the non-ADA head, for added accessibility as well as standardization of parts. However, CONTRACTOR may propose alternate fixtures for the non-ADA head where required by physical limitations.

1. **Toilet:** Toilets shall be commercial, low volume flush, fresh water and shall be piped to the collection and holding tank(s) specified in Section 123. Toilets in both heads shall be ADA compliant, vitreous china top spud, floor mount/floor outlet, commercial, elongated bowl, low volume flush. The toilet heights shall comply with PVAG. Toilet drains shall

be 3-inch. Toilet seats shall be solid plastic, elongated, with check hinges, ADA compliant.

2. **Hand Rails:** (1 horizontal and vertical set per ADA head) stainless ADA compliant handrails arranged for wheelchair transfer
3. **Sinks:** Sinks shall be stainless steel. Sink design, installation and arrangement in the ADA head shall comply with the requirements of the ADA and PVAG. This includes clear space, reach, and turning radius for the approach.

Faucets shall be contemporary, single holed, ADA compliant, commercial grade, infrared electronic sensor operated, tempered mixing-type. Electronic sensors shall be hard-wired. Finishes are to be approved by the Authority

The ADA passenger head sinks' hot water and cold water supply lines shall be arranged with inline valves; ¾" garden hose fittings with removable handle; and fitted with short lengths of hose for filling mop buckets. This valve and piping arrangement shall be installed as operationally accessible as possible for crew use in filling deck washing buckets.

4. **Mirror:** ADA compliant mirror
5. **Soap Dispenser:** ADA compliant, sensor operated soap dispenser (liquid).
6. **Toilet Paper Holder:** ADA compliant stainless steel toilet paper holder (double roll)
7. **Hand Dryers:** ADA compliant electric hand dryer.
8. **Waste Receptacle:** 3-gallon stainless trash receptacle with removable front panel for trash liner cleaning and door. All elements shall meet control and reach range ADA requirements.
9. **Baby Changing Station:** (in ADA head) Baby changing station to be horizontally or vertically hinged according the head arrangement and clearance for 60" ADA turning circle with the changing surface mounted between thirty-four and thirty-six (34-36) inches above floor height.
10. **Lighting & Exhaust Fan:** per see Section 331.3
11. **Heater:** Panel heater, radiant (see Section 511.5)

645 PASSENGER SPACES

645.1 GENERAL

The passenger accommodation spaces shall be refinished to a high commercial standard with suspended ceilings, lined side bulkheads from the deck to window sills, carpeted deck covering, recessed lighting, and quality furnishings. The Contractor shall recognize that this is a "commuter" vessel and that simple, easy maintenance is desired; however, a solid level

of comfort and ambiance shall be incorporated. The Contractor is encouraged to invest a substantial effort towards this end. Wheelchair securements shall be recessed into the floor such that they do not protrude above the floor and create a tripping hazard when not in use.

645.2 MAIN DECK PASSENGER SPACE

645.2.1 SEATS

The main deck passenger cabin seating shall be removed. All seating bases shall be replaced in-kind with new, which shall continue to provide on-board storage. The Contractor shall remove all seats and replace with new, including a new hinged mechanism for tipping the seats open for access the storage and hatches underneath. If possible, Contractor's seat replacement proposal shall incorporate individual seats, or a bench with clearly distinguished individual seating areas. Seating next to the aisleways shall incorporate handles on the backrests to aid passengers as they move through the vessel while underway. Samples of seating upholstery and frame finish shall be submitted to the Authority for approval. **[CDRL 645-1]**.

The main deck passenger cabin shall be fitted with (2) ADA mobility device positions conforming to the requirements of the US Access Board Accessibility Guidelines. The location and arrangement of these spaces shall be submitted for Authority review and approval. Wheelchair tie downs shall be mounted at each mobility device position and shall be flush with the deck to avoid any tripping hazards. The location and design shall be approved by the Authority.

Aisles and passageways between seats, tables, counters, posts and other fixed objects shall be thirty-six (36) inches minimum width. Wheel chair positions shall be scoped according to PVAG Table V222.3, excerpt included below:

Table 4: Number of Wheelchair Spaces – from PVAG Table V222.3

Number of Seats	Minimum Number of Required Wheelchair Spaces
1 to 60	1
61 to 120	2
121 to 180	3

Wheelchair seating positions shall be oriented to access a table. Wheelchair spaces shall be dispersed and located in different sections of the main deck (e.g. one in center of main deck, one next to window, etc.).

645.2.1.1 OPTION 1: INCREASED MAIN CABIN PASSENGER SEATING

Due to the addition of wheelchair tiedowns, and the potential removal of other passenger seating to provide clear ADA/PVAG compliant clear paths, a reduction in seating capacity is anticipated. The Contractor shall provide in its proposal, a conceptual design and cost proposal for an optional increase in passenger seats on the

main deck interior. Seating shall be maximized to the extent possible within the design limitations, ADA passage requirements, and reasonable comfort levels. Full size tables shall continue to be provided in the passenger area.

645.2.2 TABLES

The main deck passenger cabin tables shall be cleaned and reconditioned by the Contractor. Table laminate top inserts shall be removed and replaced with new material, approved by the Authority.

645.2.3 ADA ACCESSIBILITY

The layout of the main deck passenger space shall be submitted to the Authority for review and approval. This shall include ADA/PVAC circulation, depicting the required clear path widths and turning radii for mobility device access. It is anticipated that the two side facing benches forward in the passenger cabin will need to be removed to allow for appropriate turning radii for bow loading. Contractor shall confirm this and, if necessary, remove those benches. The use of flip up seats may be included in Contractor's design if necessary to providing ADA access and/or mobility device locations while maximizing passenger seats.

645.2.4 CEILINGS

Contractor shall remove the existing ceiling panels and associated hangers and hardware. Contractor shall replace the ceiling with a new "snap-in" 2'x 2' (600 mm x 600 mm) panel ceiling, with recessed LED lighting (see Section 331). Ceiling tiles shall be Dampa AL-15 600 mm x 600 mm beveled edge in Pure White 4747-2, or Authority approved equal.

645.2.5 INTERIOR BULKHEAD LININGS

Interior bulkhead linings shall be removed and replaced with 25mm joiner panels, or Authority-approved equal, with fire rated finish, plastic covered aluminum sheathing as proposed by the Contractor and USCG approved with finishes and colors approved by the Authority.

645.2.6 OTHER INTERIOR AMENITIES

Coat hooks shall be positioned conveniently throughout the space in close proximity to seating. Contractor shall provide four new 18-gallon, covered, built-in, stainless steel trash receptacles located with two forward and two aft, secured against vessel motion.

645.3 UPPER DECK

The upper deck passenger seating area shall have all non-skid material removed and replaced with new (as per Section 631) The passenger area enclosure's structure shall be inspected and repaired as necessary. The sides shall be replaced with new, including but not limited to,

panels, canvas, isinglass, and fasteners. The roof of the passenger enclosure on Lightning shall be replaced with aluminum, Flying Cloud's aluminum roof shall be inspected for damage and repaired if necessary.

The upper deck passenger seating shall be inspected. All paint shall be removed from the aluminum seating surfaces. The Contractor shall properly apply new paint to the upper deck passenger seating as approved by the Authority.

646 PILOTHOUSE SPACE

The pilothouse console shall be removed and disposed of by the Contractor. The Contractor shall work with the Authority to develop specific locations for all equipment, alarms, etc., and shall work with Authority to finalize the arrangement, through review of the pilothouse console mock up required by Section 646.1.

Particular consideration shall be given to providing forward visibility, good ergonomics, and the reduction of glare and reflection from internal instrumentation. The vessel shall be designed for operation from a traditional pilothouse centerline helm station as well as via the wander lead required by Section 568.

The pilothouse shall be fitted with:

- Control and navigation console
- Conning station on centerline
- Publication rack, one shelf
- Storage locker for safety gear, signal gear, foul weather gear
- Frames for required USCG documents
- Navigation, control, and alarm equipment

The console shall be fabricated from aluminum frame and sheathed with low reflective decorative laminate (Color to be approved by the Authority). The pilothouse and console design shall afford the operator with excellent visibility of the following simultaneously:

- Exterior - The Operator's view for navigation of the vessel must not be in any way degraded through the overhaul.
- Bow - The vessel operation is such that the Operator stands aft of the console while pushing the vessel against the dock radius. It is essential that the Operator have a clear view of the bow for docking, and for passenger loading and off-loading activity.

- Interior Instrumentation – . All displays shall be readable in sunlight. All primary and safety controls and equipment shall be provided with night backlighting and shall have brightness controls dim to dark.

The Contractor shall provide and install a vinyl upholstered, fixed helm chair w/pedestal, Llebroc, or equal. The chair shall incorporate the ability to slide backwards to accommodate operation of the vessel while standing. The Contractor shall submit to the Authority, for approval, a package indicating the proposed pilothouse chair and color(s) prior to purchase.

Contractor shall remove the existing ceiling panels and associated hangers and hardware. Contractor shall replace the ceiling with a new “snap-in” 2’x 2’ (600 mm x 600 mm) panel ceiling, with recessed LED lighting (see Section 331). Ceiling tiles shall be Dampa AL-15 600 mm x 600 mm beveled edge in Black 7000-6, or Authority approved equal.

646.1 PILOTHOUSE CONSOLE MOCK UP

Contractor shall develop a mock-up of the pilothouse console to demonstrate the layout of the pilothouse equipment and controls. This mock-up will be utilized for Authority’s review of interference, maintainability, and ergonomic and logical operational functions. The mock up may be created either as a physical mock-up, or as a 3D virtual mock up, as described below.

Regardless of the mock up type selected, Contractor must submit to the Authority for review a drawing package depicting all key components of the pilothouse and console arrangement before the mock up will be reviewed by the Authority. Subsequent to Authority’s initial drawing review, Contractor shall revise the design and mock up per the Authority’s initial comments and a Mock-up Review Meeting shall be scheduled during which the Authority and Contractor shall jointly review the mock up.

At the Mock-up Review Meeting, the Contractor shall work with the Authority and other Authority-designated employees and/or sub-contractors to verify the exact placement of all equipment, to eliminate possible interferences, to maximize maintenance accessibility, to promote ergonomic and logical operational function, and to review visibility of critical areas from operator’s seat. All changes identified at the meeting shall be recorded in meeting minutes. Contractor shall revise the mock up and the design drawings per the Authority’s comments at the Mock-up Review Meeting. The drawing package shall be resubmitted for Authority review.

Drawings shall include at a minimum:

1. Full view of console and other pilothouse equipment
2. Details of console areas, including arrangement of controllers, knobs, buttons, alarms, displays, cutouts, circuit breaker panels, emergency equipment, sun screens, etc.
3. Depiction of ergonomics for a 5th percentile female or 95th percentile male operator. (e.g. seat, accessibility of controls, visibility)

4. Depiction of visibility of bow for a 5th percentile female or 95th percentile male operator.

646.2.1 PHYSICAL MOCK UP METHOD

The Contractor shall fabricate a full-scale mock-up of the proposed console out of lightweight plywood or other suitable material and assemble this mock-up in an interior space made suitable for the purpose. Portable full-scale cutouts of all console mounted equipment including controls, instrumentation, alarm panels, screens, et cetera shall be provided.

When all equipment has been placed, photographs shall be taken of the arrangement and accurate dimensions shall be verified. The pilothouse console shall be constructed, and equipment installed according to the approved mock-up plan.

646.2.2 3D VIRTUAL MOCK UP METHOD

Should the Contractor choose to develop a 3D virtual mock up in lieu of a physical mock up, Contractor shall nonetheless be required to submit a 2D drawing package to the Authority for review and response, per the requirements of Section 646.2, prior to scheduling the Mock-up Review Meeting. The 2D pilothouse console drawing package shall contain sufficient detail to show all instrumentation and controls and their proposed location, make and model. This should include a wide-angle view of the entire console, as well as detail drawings, as necessary, for a full understanding of the design and equipment. Drawings shall also be provided to demonstrate visibility for a 5th percentile female and a 95th percentile male operator according to ASTM F1166.

Subsequent to the Authority's review of the 2D drawings, and Contractor's completion of any requested modifications, the Mock-up Review meeting shall be held at which Contractor shall present the 3D virtual mock up to the Authority.

At the Mock-up Review Meeting, Contractor shall display the mock up on a large display suitable for simultaneous viewing by all attendees (e.g. projected onto a wall or screen, or on a large conference room display screen). Contractor shall also have personnel in attendance who can manipulate the mock-up, including rotating, scaling, identifying components, and hiding walls and other objects that obstruct the view of key items, and any other functions required for a full review of the mock up.

650 MACHINERY SPACES

The overheads of the engine room, jet room and other voids shall be inspected and repaired as required by Section 130.2.

All machinery and void spaces shall receive a cleaning of overheads, bulkheads, decks, bilges, voids, etc. to the approval of the Authority. The engine and jet rooms shall be repainted per Section 631.4.

651 COMMISSARY SPACE

The Contractor shall remove the entire existing Main Deck aft Commissary arrangement, furnishings, and equipment. Equipment to be retained shall be moved to safe, secure, weather protected storage at the Contractor's facility. A Commissary Plan shall be submitted to the Authority for approval. The Plan shall include ADA counter arrangements, storage arrangements, major appliances installs, drainage, and electrical.

The Contractor shall allow for scrapping of all removed equipment; however, prior to disposal, the Authority shall be given an opportunity to identify any equipment and/or materials that will be saved for the Authority's inventory.

The Contractor shall propose to the Authority a re-designed, ADA/PVAG-compliant commissary area, that will fit into the existing footprint, minus any area reallocated to the ADA head. Contractor shall submit detailed drawings of the Commissary layout for review during the design phase. The newly designed commissary layout shall be approved by the Authority. The Contractor shall submit plan and elevation renderings of the commissary depicting PVAG compliance, CFE and OFE equipment, and portable Operator Furnished equipment such as Microwave, Toaster, Coffee Brewer, Chip Racks, Cup Racks, etc.

The commissary shall include a new commissary service counter framed with aluminum tubing or angle and sheathed with aluminum panels and coated with a laminate. The counter top shall be stainless steel and shall incorporate a low sea rail to contain any spillage. A plexiglass barrier ("sneeze guard") between the crew and passengers shall be integrated into the design of the commissary in a visually pleasing manner.

A section of the counter shall be a minimum of 36 inches long and a maximum of 34 inches above the finished deck and comply with PVAG accessibility requirements. Counter design and material shall be approved by the Authority.

The following equipment shall be provided and installed per the approved commissary plan:

1. Stainless steel sink with hot/cold water and hot water booster
2. 2 or 3 bay, top loading, under counter beverage chest cooler, hard wired, or similar capacity in multiple units
3. Lockable storage cabinet.
4. Insulated ice chest with drain leading to deck drain, hard wired.
5. One (1) Duplex 120V, 20amp receptacle and appropriate counter space located in a suitable position to accommodate a microwave
6. Hardwire connection and appropriate counter space for a 240V coffee brewer located in a suitable position.
7. Four (4) additional Duplex 120V, 20 amp receptacles for general use

All equipment, shelving, counters, etc. shall be securely mounted to structure in accordance with Good Shipbuilding Practice. The Contractor shall test, to the approval of the Authority, all commissary equipment, re-installed and new, for proper operation prior to the vessel's delivery back to the Authority.

654 UTILITY SPACES

A utility closet shall be installed within the ADA passenger head or other Authority approved location. It shall be provided with shelving sized to store cleaning and sanitary supplies. The closet shall be equipped with a joiner door, lockset, and locally switched LED light fixture within (See Section 331.13). The clear deck area shall be large enough to store a standard wheeled mop bucket beneath the shelving.

The Contractor shall design and implement an Authority-approved modification to the storage area forward in the main passenger cabin beneath the forward windows. This open space, currently used for storage, shall be enclosed and provided with locking doors to provide additional, secure storage on the vessel. Cabinet locks shall be keyed alike.

671 LUGGAGE STOWAGE

Contractor shall clean and inspect the luggage rack located forward on the port side of the main passenger cabin.

672 TICKET COUNTER

The existing ticket counter shall be removed, and Contractor shall design a new ticket counter with integral plexiglass barrier (“sneeze guard”), to be approved by the Authority. The ticket counter’s finishes shall be integrated with the interior design of the vessel. Plexiglass barrier shall be designed such that removal or replacement of the plexiglass shall be easily achieved without physical damage to the ticket counter should the plexiglass become damaged or scratched, or should it be decided to remove it completely. The ticket counter shall be provided and installed, such that fares can be collected/sold when passengers embark or disembark. Within 120 days of NTP, Contractor shall submit ticket counter designs to the Authority for review and approval. The ticket counter shall be equipped, at a minimum, with the following:

1. Lockable cover to contain cash and ticket drawers
2. Lockable ticket and cash drawers to secure cash and unused tickets
3. Provisions for a point of sale terminal
4. Two (2) Duplex 120-volt outlets
5. Space for signage

The ticket counter shall be designed to be unobtrusive to passenger flow, particularly in emergency situations, and shall not significantly obstruct passenger view through windows.

673 BICYCLE RACKS

Bicycle racks shall be provided, with storage capacity for 8-10 bicycles on the exterior of the main deck. Racks shall be securely attached to the forward deck. Design to be submitted to the Authority for approval.

900. TESTS, INSPECTIONS, TRIALS & SERVICES

The Authority or the Authority's designee shall have the right, but not the obligation, to observe all testing and inspections performed on the completed vessel prior to shipment to the Authority.

Within 30 days of NTP, Contractor shall submit for Authority review and approval an Overhaul Inspection and Test Plan in Excel or other Authority-approved format. This plan shall be a list of all tests and inspections to be performed with the exception of the Functional Tests (see Section 983), Dock Trials (see Section 984) and Sea Trials (see Section 985), which are addressed separately in the Sea Trail Plan. This shall include, at a minimum, all:

- Initial Inspections (see Sections 902.1, 902.5)
- Pre-Overhaul Tests and Inspections (see Section 903)
- In Process Inspections (See Section 904)
- First Article Inspections (see Section 905)
- Credit Drydocking (see Section 906)
- Survey and Measurement (see Section 981)

The Overhaul Inspection and Test Plan shall contain the same minimum information as required for the Sea Trial Test & Inspection Plan detailed in Section 982.2.

At least 30 days prior to each test or inspection, the Contractor shall submit a procedure for Authority review and approval. Procedures shall contain the same minimum information as required for Sea Trial Procedures, as detailed in Section 982.3. The Contractor must not schedule or perform tests without MBTA approval of corresponding test procedures.

A test or inspection report shall be submitted to the Authority following each test or inspection within five business days of the test completion. Test reports shall include a clear indication of the data collected and a determination of whether they passed or failed the test criteria and must be signed and dated by the witnesses and those performing the tests.

If any vessel or any apparatus, fails to satisfy the specified performance and design criteria, the vessel or apparatus, with the necessary adjustments, must be retested at the Contractor's expense.

901 PRE-BID INSPECTION

Notwithstanding anything in the Contract to the contrary, it is understood and agreed to by the Contractor that the Massachusetts Bay Transportation Authority has provided the Technical Specification for the sole purpose of describing, in general terms the performance required from each vessel, each vessel's systems and the discrete subsystems that make up the vessel. The specification provided by the Authority does not in any way constitute a design of the vessel or of such subsystems or discrete components. It is further understood that the Authority makes no representations regarding the Technical Specifications. It shall be incumbent on the Contractor to verify the accuracy of the Technical Specifications prior to the time of the bid.

It is strongly recommended that bidding Contractors thoroughly inspect the vessels prior to submitting bids to clearly understand the entire task and to identify potential interferences and/or inconsistencies which may not be readily discernable in the Contract bid package. It is the Contractor's responsibility to identify potential interferences and to allow for the relocation of piping, wiring, foundations, ductwork, and structures due to interferences and inconsistencies. Any such interferences or inconsistencies shall be brought to the attention of the Authority and a resolution agreed upon

Inspections can be arranged by requests to the MBTA, as described in the Commercial Specification. Both vessels are currently operated as back-up vessels and are typically berthed, when not in revenue service, at the MBTA maintenance pier in Quincy, MA.

Failure to perform a ship check on the vessels and become knowledgeable of specification requirements, federal, state, and local laws, ordinances, and regulations will in no way relieve the Bidder(s) of any provision of the final contract and may be grounds for disqualification from bidding.

902 VESSEL TRANSPORT TO CONTRACTOR AND INITIAL INSPECTIONS

902.1 PRE-SHIPMENT INSPECTION

Prior to shipment of each vessel to the Contractor's facility, the Contractor and the Authority shall perform a joint inspection of the complete vessel to document its condition prior to transport. Contractor shall provide a written report and Release for Shipment for Authority concurrence.

902.2 TRANSPORT TO CONTRACTOR

Contractor shall be responsible for transport of each vessel from an Authority-designated location in the Greater Boston Harbor area to Contractor's facility. Transport shall comply with the requirements of Section 987.

902.3 REMOVAL OF CONSUMABLE STORES, SEWAGE & BILGE SLOPS

The vessel shall be provided to the Contractor with a normal complement of consumable stores including fuel oil; lube oil, hydraulic oil, filters, chemical additives, and miscellaneous stores. After transport to the Contractor's facility, the Contractor shall be responsible for transfer of consumable stores, sewage and bilge slops from the vessel as required to facilitate the vessel overhaul. Costs for removal, and disposal as required, are to the Contractor's account. Disposal, when required, shall be in accordance with all federal, state, and local regulations.

- Fuel oil shall be metered off and properly disposed of. Contractor shall be responsible for fuel costs to refuel the vessels after overhaul as required for tests, trials, transport, and required conditions at conditional acceptance.
- Dirty Oil and bilge slops shall be removed and properly disposed of. The Contractor should estimate 200 gallons.

- Sewage shall be removed from the CHT tanks and properly disposed of. The Contractor should estimate 100 gallons.

902.4 GAS FREEING

Hull void spaces and tanks that are scheduled for entry or hot work – particularly in way of sewage and fuel oil tanks, shall be cleaned and tested fit for entry or gas freed. This includes all voids, the fuel oil storage tanks, engine room and jet room bilges, and all other spaces required to complete the Contract work.

902.5 RECEIVING INSPECTION

As soon as practical after drydocking at the Contractor's facility, the Contractor and the Authority shall jointly perform a visual inspection of the underwater hull and appendages for deterioration, damage, and other defects.

The Contractor and the Authority shall also perform a joint inspection of the entire vessel. This inspection shall be a thorough assessment of all systems and areas specified for work under the contract. Contractor shall provide a written report for Authority concurrence.

These inspections shall identify any damage incurred in transport to the Contractor's facility, which shall be repaired at the Contractor's cost. In addition, any other work identified that was not previously visible shall be documented, assessed, and estimated promptly and shall be considered Hidden Damage (See Section 025).

Any pre-existing deficiencies discovered by the Contractor during the Contract work, must be reported to the Authority and a plan of remediation recommended. Any such deficiencies not covered in these Specifications or Drawings will be subject to correction at the Authority's expense.

903 PRE-OVERHAUL TESTS AND INSPECTIONS

903.1 SPEED TRIAL

Upon arrival of the first vessel at Contractor's facility, Contractor shall perform a speed trial to determine the vessel's top speed and service speed (at 85% power) with sea trial deadweight. Contractor will be responsible for simulating the sea trial deadweight described in Section 985.5, Table 5 through the addition of barrels of water, or other approved method, properly arranged to simulate the full sea trial deadweight, balanced to replicate actual loading in revenue service. Contractor shall provide a plan for Authority review for arrangement of the sea trial deadweight. The Authority or its representative shall be present to witness the test. The achieved speeds shall be the minimum required sea trial speeds after overhaul, minus any Authority-approved speed reduction due to increased vessel weight during overhaul. The results of the pre-overhaul speed trial shall be submitted to the Authority for review within 5 days of the trial **[CDRL 903-1]**

903.2 HULL SURVEY

Contractor shall be responsible for any hull survey work supplemental to the information provided by the Authority that is necessary to provide adequate information for overhaul of the hulls on both vessels. This shall include a thermal infrared survey of the M/V LIGHTNING similar to that which was conducted on the M/V FLYING CLOUD in April 2020. See Appendix B. **[CDRL 903-2]**

903.3 SOUND AND VIBRATION MEASUREMENTS

The Contractor shall engage an independent Sound Contractor to measure sound and vibration levels on sea trials and to provide a report of findings to the Contractor and the Authority **[CDRL 903-3]**. These shall be considered the baseline conditions for the post-overhaul sound and vibration sea trials described in Section 985.7.

The measurements shall record the following while operating the vessel at normal operating RPM of 85% power:

- Average interior sound level in the main deck passenger cabin.
- Exterior engine noise measured at a point 100 meters from the side of the vessel

Vibration levels in the main deck passenger space shall be measured and assessed in accordance with the standards of ISO 6954:2000, *Guidelines for the Measurement, Reporting, and Evaluation of Vibration with Regard to Habitability on Passenger and Merchant Ships*, or other suitable standard approved by the Authority.

Results of the sound level and vibration measurements shall be provided to the Authority.

If average interior sound levels exceed 75 dBA, Contractor shall propose for Authority approval, a feasible reduction in sound levels that can be achieved through the overhaul. To the extent possible, the proposed post-overhaul average interior sound level shall not exceed 75 dBA. This agreed upon post-overhaul average interior sound level shall be used as a testing criterion in the Sea Trials described in Section 985.7.

903.4 HAZMAT SURVEY

See Section 102.

904 IN-PROCESS INSPECTIONS

904.1 GENERAL

All materials and workmanship shall be subject to inspection by the Authority, the USCG, and other regulatory bodies having jurisdiction. All inspection and observation of tests by the Authority will be performed in such a manner as not to unnecessarily delay the Contract work.

The Authority shall promptly approve all work and material conforming to the requirements of this Specification and shall promptly reject all work and materials which do not conform. Such rejected work or material shall be marked and isolated until satisfactorily corrected.

All costs of testing and inspection procedures and related equipment/parts shall be borne by the Contractor.

904.2 SCHEDULING & ATTENDANCE

The Contractor is responsible for scheduling and presenting all completed work for Acceptance Inspections and for giving written (email sufficient) advance notice (normally 24 hours) to the Authority, USCG, and other required inspection agencies that such work is complete, has been passed by the Contractor's Quality Assurance (QA) department, and is ready for such inspection. Inspections shall, when possible, be scheduled and accomplished during normal workdays on the Contractor's day shift and shall not constitute a delay to the Contractor's production schedule.

The Authority will make every effort to maintain communications with the parties involved and to report to the inspection site per agreed schedule. If the Authority is unable to keep the schedule, they shall notify the Contractor as soon as possible and reschedule for a mutually agreeable time. Failure of the Authority to attend an inspection does not constitute an acceptance of the work. Inspections by the Coast Guard or other agency do not eliminate these requirements for inspection and acceptance by the Authority.

904.3 PREPARATIONS

Work presented for inspection shall be complete in all respects, clean, free of debris, scrap, lines, welding wire ends, and all temporary gear. Reasonable accommodations shall have been made for access, lighting, and fresh air supply in advance of the inspection party.

904.4 REQUIRED INSPECTION POINTS

Contractor's shall provide opportunities for the Authority or the Authority's representative to inspect all critical and/or hidden areas prior to their closure or covering. These inspection points shall include, but not limited to, at a minimum, all inspections in the following sections, and shall be indicated on the Contractor's project schedule (see Section 006.10).

904.4.1 COVERING OR CLOSING AREAS

Prior to the application/installation of paint, deck covering, insulation, sheathing, joiner work, ceilings, etc., all structure and weld that is to be covered will be given final inspection and will be signed off by the Authority, this includes repairs to the hulls. Particular attention must be paid to all welds to ensure that they have been thoroughly wire-brushed and all weld smoke removed. Welds not passing visual inspection will be repaired to the satisfaction of the Authority.

It shall be clearly understood by the Contractor that the Authority has the right and option to require removal of any or all coverings for inspection in areas that have not

been previously inspected and passed. This requirement makes it essential that weekend and night shift foremen, for both Contractor and Subcontractors, stay in close communication with the Contractor's QA Department and with the Authority. Work areas are NOT to be covered or concealed until inspected and approved by the Authority.

904.4.2 COMPARTMENT COMPLETIONS

Tanks and voids, passenger spaces, work and machinery spaces shall be inspected and certified complete by the Authority and the Contractor's Representative. Machinery spaces shall include documented tests for all machinery and equipment. A compartment shall not be considered accepted until the checklist is complete, deficiencies are corrected, and the Authority and the Contractor have signed off on the space. At this time, so far as is possible, the compartment shall be secured, and no further work shall be conducted within the space unless approved by the mutual consent of the Authority and the Contractor.

The intent of the foregoing paragraph is to guarantee that the Authority will receive, at delivery, a fully operational vessel which is immediately capable of entering regular on-line service. Equipment and systems, which are operational upon the vessel's delivery to the Contractor, are to be operational upon the delivery of the vessel back to the Authority, unless they have been removed or de-activated under the terms of this Contract.

904.4.3 TANK INSPECTIONS

Prior to the final closing of any tank, a First Article Inspection shall be successfully completed (See Section 905), during which the Authority shall have confirmed that:

- a. Structure and welding are complete
- b. Air or hydro test has been passed
- c. Filling and suction piping is complete and tested
- d. Vents, sounding tubes, striking plates, level indicators, and hi/low level alarms are properly installed and tested
- e. Coatings have been applied per the paint schedule
- f. The tank is clean and free of all debris
- g. Pre-existing tanks shall be inspected for items d, e and f above.

NOTE: ANY tank/void space to be inspected must be properly ventilated and certified gas free by a marine chemist and certificate must be located outside each tank/void space being inspected.

904.4.4 PIPING – FLUSH TESTING

All new or modified hydraulic fluid and fuel piping systems shall be thoroughly cleaned and flushed of all foreign matter with the appropriate system medium or an approved substitute. Hydraulic fluid, lube oil, fuel oil, etc. for testing purposes and for initial start-up of equipment shall be provided by the Contractor. Waste oil piping and suction piping must be pressure tested in accordance with the approved procedure.

The new or modified piping shall be tested, signed off, and approved by Contractor and Authority. The Contractor must determine the maximum permissible test pressure for each system component. Extreme care should be used to prevent over-pressurization of piping systems undergoing testing.

Prior to flushing any system, proper care and attention must be given to systems that will require to be blocked off, removed or bypassed, due to in-line mechanisms, valves or machinery that may be capable of trapping debris or foreign matter.

904.5 RE-INSPECTIONS

Any welding, burning, heat shrinking, etc. which is performed as rework, repair, or on change orders after an inspection has been completed, shall require (at the Authority's option) the removal of any or all coverings for re-inspection of plate, welds, etc. This requirement will further emphasize the necessity of a formal QA Inspection process and the necessity for close communications between the Contractor and the Authority. An initial inspection in no way negates the requirement for re-inspection if an area is reworked in any manner.

If the above required rework, repair and inspection is due to the request of a change order by the Authority, any additional cost incurred for inspection will be paid by the Authority. If rework and inspection is the result of rejection of work by the Authority following an inspection, the Contractor will bear the cost of re-inspection.

904.6 UNDERWATER HULL INSPECTION (AS APPLICABLE)

If at any time prior to the Authority's acceptance of the vessel, there is reason to believe that the underwater portion of the vessel shall have been damaged, that coatings shall have failed, or that equipment or appendages require out of water maintenance due to the Contractor's or a Subcontractor's negligence or due to an evolution conducted in good faith by the Contractor but resulting in damage, the Contractor shall contract for an independent certified diver's inspection of the underwater hull.

A copy of the diver's inspection report shall be provided to the Authority and USCG Inspector. In consideration of this report, the circumstances surrounding the damage, and the extent of damage which determine the damage to be a "warranted reason", the Contractor shall "haul out" (drydock) the vessel and adequately repair, clean and paint the damaged areas at the Contractor's expense. A protest report (Form CG-2692 Report of Marine Casualty) filed by the Authority with the USCG Local OCMI and sustained by the Local OCMI, shall be deemed a "warranted reason" for requesting dry-docking.

If said Underwater Inspection is requested by the Authority, yet deemed unnecessary by Contractor, the cost of inspection will be borne by the Authority if the inspection report finds no discrepancies. If warranted discrepancies are found, the cost of inspection, as well as the cost of haul out (drydocking) and the cost of repairs, shall be borne by Contractor.

905 FIRST ARTICLE INSPECTIONS

At the request of the Authority, the Contractor shall make arrangements for the Authority and/or other Authority-designated personnel to visit vendor's or subcontractor's sites to witness equipment tests, inspect facilities, etc. The Authority shall be notified of the dates for FAIs at least 30 days in advance. Any travel by the Authority shall be at the Authority's expense. The anticipated FAIs include, but are not limited to the following, at the Authority's discretion:

1. Main Engines
2. Generators
3. Jet Drives
4. Steering Control System
5. HVAC System
6. Fuel Tanks
7. Passenger Furnishings
8. Tanks - including water and sullage
9. Passenger Information System

906 CREDIT DRYDOCKING

Each vessel shall undergo all requirements of the USCG-required bi-annual drydocking and USCG inspection as close as practical to delivery of the overhauled vessel to the Authority. This is to maximize the time between the vessel delivery and the next required drydocking by the Authority.

The Contractor's overhaul of the vessel shall address all items that would otherwise result in USCG findings that might delay the delivery of the vessel. However, the Contractor is responsible for determining a suitable time for the inspection that allows for any minor repairs that might be required by the USCG. Contractor shall obtain Authority concurrence on the proposed schedule, but this in no way entitles the Contractor to an extension of the delivery date if extensive repairs are required by the USCG.

The Contractor shall be responsible for communications with the attending USCG Inspector and Local OCMI, as required, to schedule and support the inspection process. Notification of scheduled USCG inspections shall be provided to the Authority in a timely manner in order that

he/she may be in attendance. Contractor shall provide the Authority with USCG documentation of the complete credit drydocking. [CDRL906-1]

981 SURVEY & MEASUREMENT

After launch and completion of the vessel, the Contractor shall be responsible for completing the following:

981.1 DEAD WEIGHT SURVEY & FREEBOARD

Contractor shall complete a deadweight survey for each vessel after overhaul – including all required preparation, and measurement of the vessel freeboard. The completed deadweight survey, including documentation of the freeboard shall be submitted to the Authority. [CDRL 981-1]

The Contractor shall prepare the vessels for the Final Deadweight Survey including, but not be limited to: adequate ventilation; access to all spaces; a “Competent Person” with equipment to ascertain the gas free condition of spaces as well as the adequacy of oxygen levels; adequate permanent or temporary lighting; and necessary incidental labor as required. Miscellaneous equipment, trash, welding machines, welding leads, etc. shall be removed from the vessel in preparation for each survey.

The Deadweight Survey shall include, but not be limited to, the inspection of all compartments and void spaces; pumping all compartments down; taking a detail report of weight to add and weights to deduct from the from the Deadweight Survey to obtain the vessels true lightship displacement; sounding all tanks; taking the specific gravity measurements of all tank fluids that are able to be pumped off; taking the specific gravity measurements of the sea water the vessel is displacing; and taking detailed freeboard measurements of the vessel in calm conditions with slack lines. During the Deadweight Survey, no other work shall be taking place on board the vessel.

The Contractor shall be prepared to provide a small powered boat or float (with operator), step ladder, carpenter’s level, plumb tape, and appropriate shipyard laborers for the support of these surveys.

The Contractor shall notify the attending USCG Inspector and the Authority of scheduled deadweight survey dates and times in sufficient time to allow attendance.

Contractor shall confirm that the measured freeboard meets the Authority-approved height per Section 008.

981.2 ADMEASUREMENT TONNAGE

The vessels, as modified, may require a re-admeasurement for domestic Regulatory and ITC tonnages. If re-admeasurement is required, the Contractor shall be responsible to have the vessel admeasured for Domestic Regulatory and ITC gross tonnages and provide the associated documentation to the Authority. The Contractor shall arrange for a major classification society tonnage surveyor to perform this work and shall assist the tonnage

surveyor, as required, in surveying the vessel. All fees associated with the issuance of new tonnage documents will be the responsibility of the Contractor. If it is determined that readmeasurement is not required, the bid cost line item shall be credited to the Authority.

The Contractor shall provide labor and materials to assist the Admeasurer in completing the vessel's Admeasurement Survey, if a survey is required. Access will be afforded to all spaces with adequate temporary lighting, ventilation, and gas free certification.

982 TRIALS – GENERAL

982.1 GENERAL

Following the launch and substantial completion of the vessel, the Contractor shall conduct a joint vessel inspection with the Authority. The Contractor shall schedule and perform Functional Tests (see Section 983), Dock Trials (see Section 984) and Sea Trials (see Section 985) to demonstrate the satisfactory operation of all equipment. Dock Trials will be performed in preparation for sea trials.

982.2 TEST & INSPECTION PLAN

At least 30 days prior to dock trials and the testing of the completed vessel, a Sea Trial Plan **[CDRL 982-1]** shall be submitted to the Authority for review and approval. The plan shall be a list of all tests and inspections to be performed, in Excel or other Authority-approved format. The test and inspection plan must include all tests required for USCG and supplier certification/commissioning as well as those required to confirm compliance with the Contract Documents.

For each test, the plan shall indicate at a minimum:

- Test Name
- System(s) or specific requirements tested
- Test location
- Supplier(s) required, if any
- Test date

982.3 TEST & INSPECTION PROCEDURES

The Contractor shall prepare and submit a test procedure for each test and inspection. Each procedure shall include all information necessary to ensure the successful, accurate and safe performance of the described test. Each test procedure shall include:

- Scope of test (what is being tested and how many)
- Safety Precautions
- Test equipment required
- Any special conditions required, including condition of the equipment under test

- Step-by-step instructions for performing the test, and set-up of test equipment.
- Test results sheet that includes:
 - Clear description of data to be collected, and spaces/table(s) in which to record the data
 - Pass/fail criteria, including applicable tolerances
 - Confirmation of test equipment used (make & model, where applicable) and certification/calibration expiration date (where applicable)
 - Sign-off location for Contractor, Authority, and if applicable, supplier (e.g. for engines, generators, propulsion, HVAC, navigation controls, etc.)

Test procedures shall be submitted to the Authority for review and acceptance at least thirty (30) days in advance of the actual testing. All procedures must be approved before testing commences.

The Authority shall have the right to delay dock trials, sea trials, functional testing and/or pre-shipment inspections, at no expense to the Authority if approved procedures are not received by the scheduled date.

982.4 TEST AND INSPECTION REPORTS

All Dock and Sea Trial data and Inspection results [CDRL 982-2] shall be recorded and provided to the Authority within five (5) business days of the test completion. No test shall be considered complete until a formal test report has been received and approved by the Engineer. Test reports shall also be included in the Vessel History Book (see Section 006.8). Test reports shall include a clear indication of the data collected and a determination of whether they passed or failed the test criteria, and must be signed and dated by the witnesses and those performing the tests. If any vessel or any apparatus, fails to satisfy the specified performance and design criteria, the vessel or apparatus, with the necessary adjustments, must be retested at the Contractor's expense.

983 FUNCTIONAL TESTS (SUPPORTED AND APPROVED BY VENDOR REPRESENTATIVES)

The following functional tests shall be performed on the completed vessel, and may – where applicable, be combined with sea trials.

- Generators
- Steering and Control System
- Main Propulsion Engines (combine with performance trials)
- HVAC (layover & underway)
- Navigation Electronics (radar heading flasher alignment, FCC radio check, AIS, GPS)
- Passenger Information System

984 DOCK TRIALS

984.1 GENERAL

The Contractor shall conduct dock trials to test all propulsion machinery, generating machinery, auxiliary pumps and compressors, electronic control, switchboards and power distribution, navigational equipment, alarm & monitoring, fire suppression and safety equipment, etc. The Contractor shall engage Technical Representatives to supervise bringing their equipment on line and proving their equipment's operational readiness for Sea Trial performance.

The Contractor shall notify the Authority and the attending USCG Inspector of the proposed date of dock trials not less than 14 calendar days in advance. The Contractor shall update the Authority of changes, delays, etc. as situations evolve. The Authority will make every effort to maintain communications with the parties involved and to report to the dock trial site per agreed schedule. If the Authority is unable to keep the schedule, they shall notify the Contractor as soon as possible and reschedule for a mutually agreeable time. Failure of the Authority to attend sea trials does not constitute an acceptance of the work. Inspections by the Coast Guard or other agency do not eliminate these requirements for acceptance by the Authority. The Contractor shall be responsible for all costs associated with dock trials, Tech Reps, fuel, consumables, etc.

984.2 REQUIRED DOCK TRIALS

Dock trials shall include but shall not be limited to:

- Water tightness (hatches, windows, doors, vessel structure, etc.)
- Fueling
- Main propulsion engine, shafting, couplings, reduction gear
- Propulsion jet thrust
- Propulsion jet steering
- SSDGs, switchboards, battery chargers, battery banks, shore power
- Electrical distribution AC and DC
- Power Source Transfer Shore Power to Generator Power & reverse
- HVAC – Engine Room Ventilation
- HVAC (heating, cooling, fresh air, alarms)
- Bilge System
- Fire pump(s) and Fire Main System
- Pumps, compressor, piping manifolds and systems
- Alarm & Monitoring
- Fire Suppression Testing & Certification
- Navigation equipment (electronic)

- Navigation equipment (non-electronic & miscellaneous)
- Lighting – normal and emergency
- Public address, Loud Hailer, Intercom, Auto Announcements, Audio-Visual, Wi-Fi
- Communications (exterior)
- Communications (interior)
- Safety and abandon ship equipment installation and readiness (SOLAS Equipment)
- Signage and documentation
- Commissary equipment
- Potable water system
- Flushing water system
- Sanitary Drain, CHT, & Suction-off System

984.3 SCHEDULING & ATTENDANCE

The Contractor shall notify the Authority and the attending USCG Inspector of the proposed date of sea trials not less than fourteen (14) calendar days in advance. The Contractor shall update the Authority of changes, delays, weather conditions, etc. as situations evolve. The Authority will make every effort to maintain communications with the parties involved and to report to the sea trial site per agreed schedule. If the Authority is unable to keep the schedule, they shall notify the Contractor as soon as possible and reschedule for a mutually agreeable time. Failure of the Authority to attend dock trials does not constitute an acceptance of the work. Inspections by the Coast Guard or other agency do not eliminate these requirements for acceptance by the Authority.

985 SEA TRIALS

985.1 GENERAL

All builders' inspections, tests and trials shall have been successfully completed prior to the delivery of each vessel to an Authority-designated facility in the greater Boston area. The Authority and/or the USCG Inspector assigned shall require performance demonstrations of vessel navigation and handling, safety equipment, and systems during acceptance and Certificate of Inspection issuance. Such performance demonstrations shall be to the account of the Contractor (See also Training Section 020), including crew, fuel, consumables and any other related expenses.

The Contractor shall conduct sea trials to verify the functionality of all overhauled, replaced or modified equipment, as well as the functionality of the complete vessel. Tests and trials shall be done to industry standards and best practices. All test results shall be recorded, and the records provided to the Authority and to the attending USCG Inspector, upon request.

Main propulsion and auxiliary machinery equipment and systems shall be tested to full operational status and to the satisfaction of the attending USCG Inspector, the Authority, and

major equipment suppliers, as appropriate. Contractor shall also inspect and functionally test all equipment and systems which were removed and replaced, or modified and replaced during the Contract. The Contractor shall be responsible for all costs associated with sea trials including, but not necessarily limited to, crewing, fuel and lube, beverages and light lunch for personnel riding, pilotage, and line handlers.

If a re-trial is necessary due to a failure of OFE equipment, the cost of the re-trial shall be paid by the Authority. If re-trial is necessary as the result of a failure of Contractor provided equipment, the cost of the re-trial shall be paid by the Contractor.

The results of all Sea Trials shall be submitted to the Authority prior to delivery of the overhauled vessel to the Authority.

985.2 SCHEDULING & ATTENDANCE

The Contractor shall notify the Authority and the attending USCG Inspector of the proposed date of sea trials not less than fourteen (14) calendar days in advance. The Contractor shall update the Authority of changes, delays, weather conditions, etc. as situations evolve. The Authority will make every effort to maintain communications with the parties involved and to report to the sea trial site per agreed schedule. If the Authority is unable to keep the schedule, they shall notify the Contractor as soon as possible and reschedule for a mutually agreeable time. Failure of the Authority to attend sea trials does not constitute an acceptance of the work. Inspections by the Coast Guard or other agency do not eliminate these requirements for acceptance by the Authority.

985.3 ATTENDEES

No less than 48 hours in advance of sea trials, Vendors and the Authority shall provide the Contractor with a list of personnel to be engaged on sea trials. The list shall include names, employer, function, and identification of each projected attendees. Identification may be TWIC, CAC, or State driver's license number.

The Contractor shall be responsible for ensuring the support of technical representatives for major equipment that was overhauled, replaced or modified, and shipyard labor for both Dock Trials and Sea Trials, as required.

985.4 SEA TRIAL LOCATION

Sea trials shall be performed in proximity to the Contractor's venue in waters of sufficient depth to allow for validation of speed and handling characteristics and of sufficient area to allow for speed and distance runs. Allowance shall be made for tests and trials that may be required by the attending USCG Inspector that are, however, not included in the following listings.

In the case of a shipyard venue being in the same USCG Sector as the Authority-designated facility in the greater Boston area, the USCG OCMI may allow all trials for the issuance of Certificates of Inspection to be performed at the Contractor's facility. This in no way limits the Contractor's delivery obligations or alters the "ownership" transfer venue of a vessel to a location other than the Authority-designated facility in the Greater Boston Harbor area.

985.5 SEA TRIAL DEADWEIGHT

Where specified, sea trials shall include weighting the vessel, at the Contractor's expense, to simulate the deadweight specified in **Table 5**. Contractor shall submit a Sea Trial Deadweight Plan to the Authority for review and acceptance prior to performance of Sea Trials.

Table 5: Sea Trial Deadweight

149 Passengers @ 185 lbs.	12.31 LT
4 Crew @ 185 lbs.	.33 LT
Luggage @ 10 lbs./passenger	.67 LT
Fuel: 1400 gallons @ 7.3#/gal	4.56 LT
Potable Water: 200 USG	.74 LT
Sewage: MT	0.00 LT
Tools, spares, commissary stores	0.50 LT
Total Speed Trial Deadweight	19.11 LT

985.6 SEA TRIAL VESSEL & AMBIENT CONDITIONS

Sea trials shall be performed under the following conditions

1. Salt water with clean bottom.
2. Sea State: Beaufort Force 3 or less
3. Engines at RPMs acceptable to engine manufacturer
4. At least one hour of the trials shall be during hours of darkness.

985.7. REQUIRED SEA TRIALS

1. Magnetic compass adjustment & deviation card
2. **Speed Trial** – The vessels will be capable of the meeting or exceeding the pre-overhaul speeds measured (see Section 903.1), adjusted as required based on any changes in vessel weight after overhaul. Deadweight conditions shall be the same as at the pre-overhaul speed trials, and as listed in Section 985.5, Table 5. Ambient Conditions shall be as listed in 985.6.

Vessel speed will be measured at approximately six (6) RPM points. Each speed point will be the average speed measured in reciprocal directions as calculated by DGPS.

Speed trials shall include all other engine & propulsion supplier test requirements.

3. **Maneuvering Trials** (emergency stop, split throttle maneuvering tests, neutral, ahead, and astern operation, turning, etc.)

4. **Emergency operation** (with one engine non-functional)
5. **Sound & Vibration Trials** – The Contractor shall engage an independent Sound contractor to measure sound and vibration levels on sea trials and to provide a report of findings to the Contractor and the Authority **[CDRL 982-6]**.

The average interior sound level in the main deck passenger cabin, while operating the vessel at normal operating RPM of 85% power and when loaded for Trial Deadweight, shall not exceed those measured in the pre-overhaul trials (see Section 903.3). Contractor's design shall keep interior sound level at or below 75dBA. If pre-overhaul average interior sound level in main deck passenger cabin (see Section 903.3) exceed 75dBA, the overhauled vessels shall not exceed the Authority-approved sound level limit developed as part of the pre-overhaul survey.

Contractor shall be responsible for ensuring that vibration at all operating speeds should not increase passenger discomfort, as compared to the pre-overhaul conditions.

Exterior engine exhaust noise shall not exceed 72dBA when measured at a point 100 meters from the side of the vessel while operating the vessel at normal operating RPM of 85% power and when loaded for Trial Deadweight.

Vibration levels in the main deck passenger space shall be measured and assessed in accordance with the standards of ISO 6954:2000, *Guidelines for the Measurement, Reporting, and Evaluation of Vibration with Regard to Habitability on Passenger and Merchant Ships*, or other suitable standard approved by the Authority. Measurements shall be made in the same manner as the vibration measurements prior to overhaul to allow for comparison. Contractor shall ensure that the vibrations measured in the post-overhaul state shall not have an adverse effect on passenger comfort as compared to the pre-overhaul condition.

6. **Night Trials** (test lighting, identify unsuitable glare to be corrected, test navigation lights, pilothouse controls & displays, searchlight, etc.)
7. **Endurance Trials** – The contractor shall operate the vessel continuously over 4 hours at approximately 85% power to ensure proper operation.

986 POST-DELIVERY TRIALS IN OWNER'S VENUE

986.1 GENERAL

Upon delivery of each overhauled vessel, all systems shall be operational, in a condition where it can receive consumable stores and go into line service upon issuance of a USCG Certificate of Inspection. All systems shall be in conformance with the current, active Certificate of Inspection. It is the Contractor's responsibility to identify and to inform the Authority, in writing, of any operational discrepancies existing upon delivery of the vessel to the Contractor's designated facility.

Upon arrival at the designated delivery location, the Contractor shall demonstrate to the satisfaction of the Authority the operation of all systems. This demonstration shall include an underway demonstration trial run at the discretion of the Authority.

Engine, gear, and jet drive lube oil shall be checked and brought to manufacturer designated sump levels. Coolant shall be checked and brought to manufacturer designated operating level. At the time of Conditional Acceptance, the vessel shall be transferred to the Authority with full fuel oil tanks. Fuel oil gauge readings shall be taken by the Contractor and the Authority as confirmation.

All USCG required safety gear shall be installed on board, inspected, and ready for use. The Contractor shall post a valid USCG Certificate of Inspection and Stability Letter.

986.2 BOARDING & DEBARKING/DOCK INTERFACE

Testing of all boarding locations on the vessel when mated with all docks in the service area. The freeboard shall meet the Authority-approved measurement per Section 008. This shall include all bow and side boarding locations and any associated bridge plates / gangways at the designated docks. This test shall also verify the suitability of the vessel's freeboard to the landside infrastructure. The Authority shall be responsible for any coordination required with dock owners in its service area for access to those facilities during testing.

986.3 NEW TO ZONE USCG SECTOR INSPECTION

The Contractor shall coordinate all USCG requirements for the New to Sector Inspection. Prior to the issuance of a Certificate of Inspection (C.O.I.) for operations in a USCG Sector that is different from the USCG Sector in which the vessel was constructed, it is normal practice for the new operating sector to verify the inspection record performed in the construction Sector.

It is common for a new Sector to require that the Authority's operating crew demonstrate proficiency in man overboard retrieval, IBA deployment, and fire suppression knowledge.

987 SHIPMENT AND DELIVERY

Contractor shall be responsible for transport of the vessel to its shipyard and return transport to the Authority after overhaul. Transport of the vessels shall be to and from an Authority-approved Boston Harbor area location and shall be performed on a schedule mutually agreed upon by the Authority and the Contractor.

One vessel shall be removed from revenue service and released to the Contractor for the first overhaul period. The second vessel shall be released to the Contractor within ten calendar days of the return delivery, completion of operational testing, and conditional acceptance by the Authority of the first vessel.

The Contractor shall be responsible for all costs of transport, including consumables, fees, and compliance with all insurance and crewing requirements for own-power, ocean freight, or

combined own-power/ocean freight deliveries. The Contractor shall provide the Authority with certificates of insurance for transport coverage prior to the commencement of each vessel move.

The Contractor shall include in their **bid documents** a proposed delivery scenario. All delivery proposals must be approved by the Authority.

A Contractor located on the US Atlantic or US Gulf Coast may deliver the vessel under its own power, on its own bottom.

A Contractor located on the US West Coast shall deliver the vessels as shipboard freight to a port approved by the Authority located on the Atlantic Coast. In such a case, Contractor shall meet the Federal requirements for shipping via a U.S. Flagged vessel. Following discharge, the vessel's delivery shall be completed by the vessel running under its own power, on its own bottom. If delivery by shipboard freight terminates in Boston Harbor or in an alternate port on the East Coast, the Contractor is responsible to take delivery from the shipper and to deliver the vessel to the greater Boston Harbor facility designated by the Authority.

The Contractor shall be responsible for complying with all insurance and crewing requirements for own-power, ocean freight, or combined own-power/ocean freight deliveries. The Contractor shall provide the Authority with certificates of insurance for delivery coverage prior to the commencement of each delivery.

Prior to transport of each vessel to the Contractor's facility and back to the Authority, the Contractor shall submit for Authority review and approval a shipment and delivery plan. [CDRL 987-1]

988 CERTIFICATIONS, REGISTRATIONS, AND OTHER REQUIRED DOCUMENTATION OR APPROVALS

Contractor is responsible for obtaining all certifications, registrations and other documentation or approvals required for safe and lawful operation of the vessel and its components. Contractor shall provide the Authority with at least 24 hours advance notice of regulatory inspections and tests. Documentation to be supplied by the Contractor includes, but is not limited to:

- Compass Deviation Card – Prior to delivery (See 982.3.6), the ship's magnetic compass shall be adjusted by a qualified compass adjuster and a Deviation Card provided.
- USCG Certificate of Inspection
- Tonnage Certificate
- EPA Diesel Emission Certificates
- FCC Radio Station Authorization EPIRB Registration

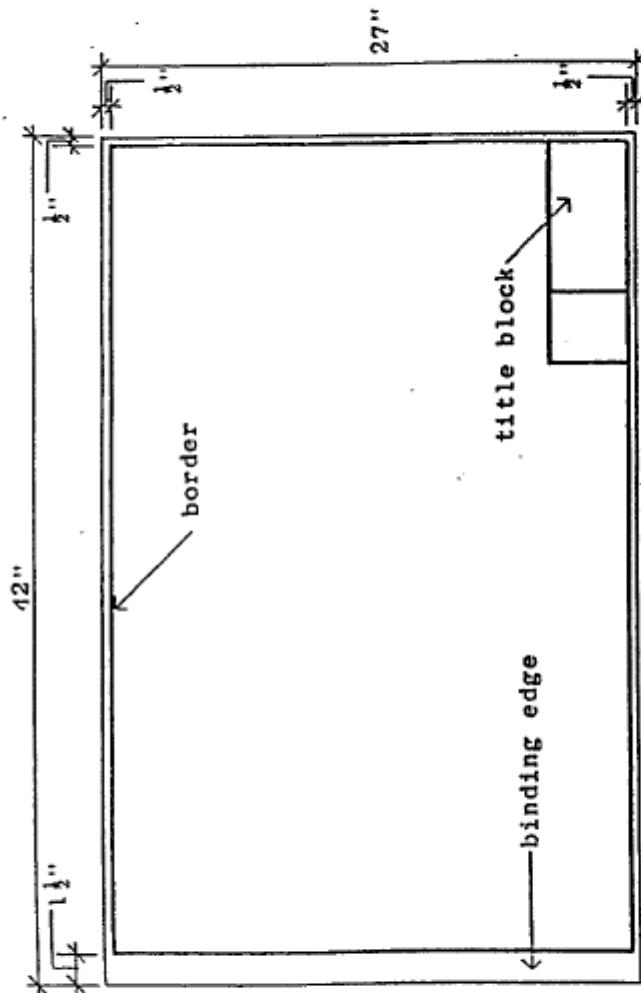
994 CLEANING

Prior to final delivery, the vessel will be thoroughly cleaned, and any necessary paint or other cosmetic damage repaired. The vessel shall be delivered to the Authority in a clean, ready for service condition.

997 DRYDOCKING

The Contractor shall be capable of “drydocking” the vessel if this is required subsequent to launching and prior to delivery to the Authority. “Drydocking” shall be by crane, travel lift, railway, floating drydock, or graving dock. It is not anticipated that a drydocking will be required; however, the capability to drydock shall be locally available.

APPENDIX A: MBTA STANDARD DRAWING FORMAT

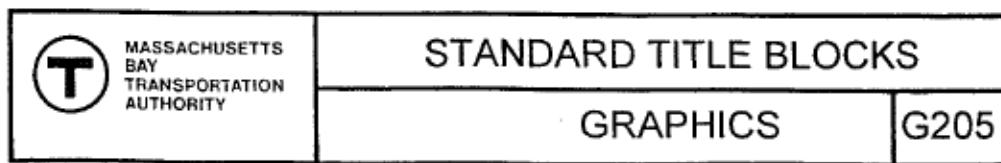
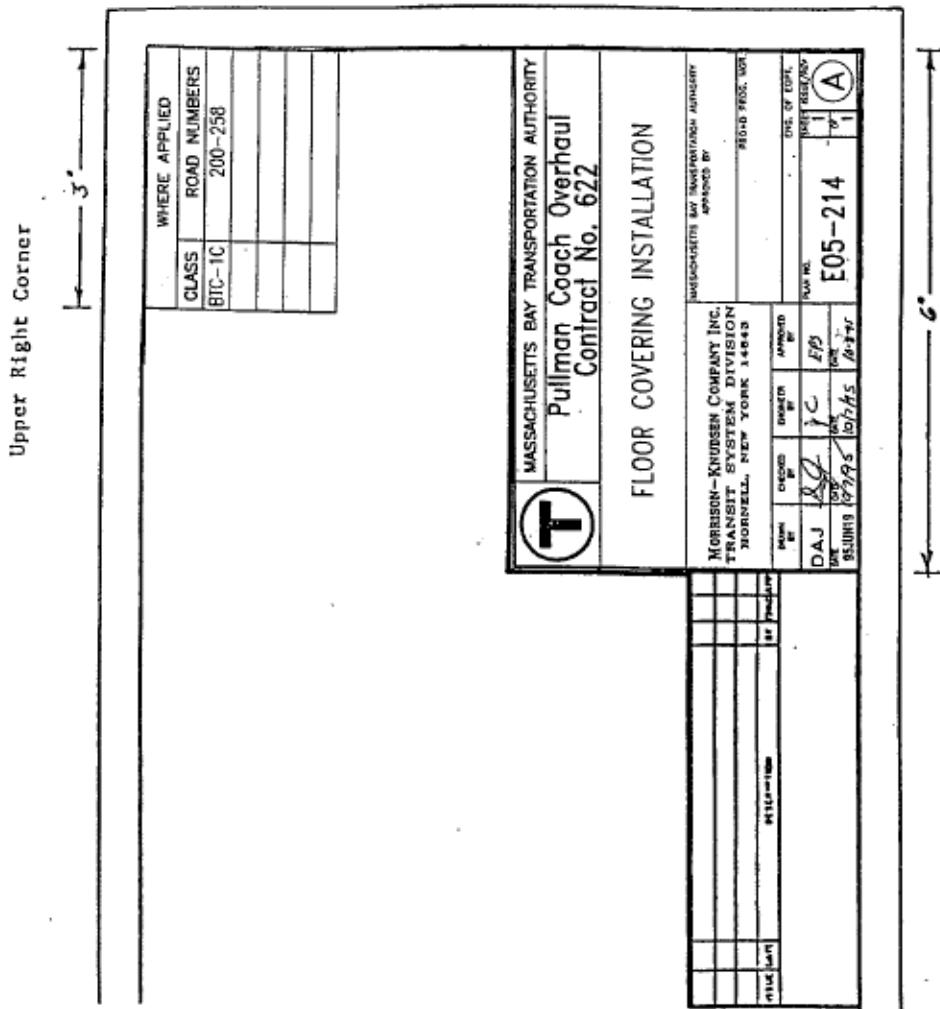


STANDARD SHEET SIZE

The standard sheet size for all Authority architectural and engineering drawings is 42" x 27" as shown. All Sheets have a border on all four sides located as shown, with 1/16" line thickness.

All sheets have the standard Authority title block, and revision block located in the lower right corner, except the cover sheet.

 MASSACHUSETTS BAY TRANSPORTATION AUTHORITY	STANDARD DRAWING SHEET	
	GRAPHICS	G200



APPENDIX B: HULL SURVEY

APPENDIX C: CCTV EQUIPMENT SPECIFICATIONS

C1. GENERAL REQUIREMENTS

- A. Furnish all items of the material, design, sizes, and ratings shown on the Contract Drawings and herein specified.
- B. All CCTV cameras, and NVRs installed under this contract shall be integrated and fully functional with the Genetec software and the integration shall be approved by the Authority. If the Contractor wishes to use a CCTV camera that meets the specifications and is not currently integrated with Genetec Security Center, then they must have the camera integrated and the integration approved by Genetec at no additional cost to the contract, and without any contract time extension.
- C. Any camera, NVR or software installed under this contract must support a non-proprietary, open architecture platform which is fully ONVIF profile S and G compliant and must have been granted the SAFETY Act Designation and Certification by the U.S Department of Homeland Security (DHS). Video management software must also be currently listed on DHS website at the time of bid.
- D. The Contractor is responsible for providing all software and licensing necessary for achieving the described functionality.
- E. All firmware and software shall be updated to the newest version prior to the close of the project.
- F. All software and hardware manufacturers shall have permanent representation and support within the United States.
- G. All equipment installed on the Ferries shall pass MIL-STD-810 Test Methodology 514.6 Tests I and III for vibration and 516.6 Test I for shock or an equivalent test, acceptable to the MBTA for functional vibration and shock in the environment in which the equipment will be used.
- H. All equipment shall be mounted with tamper-proof stainless-steel hardware and thread lock shall be used to securely hold fasteners. All connections shall use a gasket or sealant where needed and as described in the drawings and herein. The Contractor shall submit a drawing of the mounting of all equipment for approval by the MBTA prior to installation on the first vessel.
- I. The Contractor shall wire the covert switch on the vessel to also act as a trigger to the Onboard NVR to create an alarm in the core MBTA directories.

C2. MATERIAL

- A. All material shall be new and unused commercial off the shelf products and the workmanship shall be in accordance with the highest standards of the electronic equipment industry. Bids will be accepted only for new and current equipment. Equipment discontinued by the manufacturer shall not be accepted. All components shall be UL listed.
- B. Equipment purchased under this Section shall comply with applicable SAE and TIA standards, and the manufacturer's warranties against material and workmanship.
- C. Supply all equipment capable of meeting the performance requirements within the marine environment, subject to temperature, electromagnetic interference, humidity, vibration, power fluctuations, and light conditions typically encountered.

C3. MANUFACTURER/CONTRACTOR EXPERIENCE

- A. Manufacturers supplying mobile IP video recording equipment shall have a minimum five years' experience in the IP video market. Manufacturer shall have experience in design and implementation of mobile systems of this size and complexity.
- B. Upon award of Contract, the manufacturer shall agree to support all installed equipment and software for a minimum 5 years after system acceptance. This shall be submitted in a formal letter to the MBTA Project Manager from the manufacturer.
- C. The Contractor installing the IP video equipment must have experience in IP video technology and must have prior experience in implementing an IP video network of similar complexity and size.
- D. All equipment used on the Ferries shall be service proven, and the Contractor shall include two references that the MBTA can contact regard to the success of the equipment and software.

C4. CCTV CAMERA MOUNTS

- A. All CCTV camera mounts shall be designed by the manufacturer for the sole purpose of mounting the CCTV camera to a vehicle.
- B. All CCTV camera mounts shall be type as stated on the Contract Drawings. All mounting hardware shall be stainless steel and be of tamper proof design. The Contractor shall provide six tamper proof screw drivers upon the acceptance of the first vessel.
- C. The Contractor shall apply thread lock to all mounting hardware.
- D. All CCTV camera mounts shall match the color of the CCTV Camera housing to which it is attached.
- E. Any non-standard camera mount must be submitted for approval.
- F. The Contractor shall submit mounting details for approval by the MBTA including

all components, sealants, and mounting hardware.

C5. 360 DEGREE IP CCTV CAMERA

- A. The 360 Degree IP Camera to be provided under this Section shall meet, or exceed, the following requirements:
 - 1. The 360 Degree IP Camera shall be certified by the manufacturer to be fully compatible with the Network Video Recorder specified elsewhere in the section.
 - 2. The 360 Degree IP Camera shall be of a day/night (color/B&W) type with automatically removable infrared cut filter for viewing scenes at low light levels unless the 360 Degree IP CCTV Camera meets the black & white illumination requirements while still in color mode.
 - 3. The 360 Degree IP Camera shall output multiple video streams using different codecs simultaneously.
 - 4. The 360 Degree IP Camera shall stream both H.265 and H.264, minimum.
 - 5. The 360 Degree IP Camera shall include a Web User Interface.
 - 6. Any digital Pan/Tilt/Zoom functions shall be limited to login or other authentication means, such that the dedicated fields of view cannot be inadvertently changed through the software interface.
 - 7. The 360 Degree IP Camera shall be ONVIF conformant.
 - 8. The 360 Degree IP Camera shall have enough dynamic range to compensate for the wide range of ambient lighting conditions, including the difference between daylight flooding through vehicle windows and the interior lighting conditions that will be encountered in a marine environment while still providing usable images.
 - 9. The Contractor shall provide, and install, all required camera mounting brackets, adapters and associated hardware to mount the 360 Degree IP Cameras at the locations as approved by the Authority.
 - 10. General Construction
 - a. Impact resistant housing, IK10, minimum
 - b. Clear polycarbonate dome
 - c. Tamper and impact resistant CCTV Camera assembly
 - 11. Electrical
 - a. M12 connector for 100Base-TX Ethernet.
 - b. Input voltage: PoE (IEEE 802.3af) Class 2, 9.5 watts at camera; maximum
 - c. Network Link Indicator Light.
 - 12. Imaging System
 - a. Imager: Single imager, 6MP or greater
 - b. Iris Automatic iris control
 - c. Imaging Sensor: 1/1.8" or greater
 - d. Resolutions: Original: 2048x2048, 1280x1280, 1080x1080, 960x960

Single Panorama: 2048x512, 1920x480

Double Panorama: 2048x1024, 1920x960

Quad View: 2048x1536, 1600x1200, 1280x960

e. S/N Raito: 50dB

13. Minimum Illumination (No Image Enhancement, AGC On, 30 FPS)

a. Color: 0.1 Lux

b. Black & White: 0 (IR LED On) Lux

14. Dimensions:

a. Diameter: 5.75", max

b. Height: 2.59", max

15. Camera Field of View

a. Angular: H: 94.8° / V: 49.3° / D: 114.3°

16. The 360 Degree Camera assembly shall meet, or exceed, the following environmental requirements:

a. Operating Temperature: -22°F to +131°F

b. Environmental Rating: IP66

c. Compliant with EN50155 Standard

17. Networking Requirements:

a. The 360 Degree IP Camera shall include Unicast and Multicast streaming.

b. The 360 Degree IP Camera shall support the following protocols: TCP/IP, UDP/IP, IPv4, IPv6, HTTP, HTTPS, Unicast, Multicast (IGMP), UPnP, DNS, DHCP, ARP, FTP, RTP, and NTP.

c. The 360 Degree IP Camera shall be password protected.

d. The 360 Degree IP Camera shall be fully compatible with the Ethernet Switch, Network Video Recorder, and Genetec.

B. The Contractor is responsible for all 360 Degree IP Camera setting adjustments to be configured for the location and application. 360 Degree IP Camera adjustments shall include brightness, contrast, saturation, zoom level, focus, back light compensation, dynamic range, frame rate, and compression.

C6. FIXED IP CCTV CAMERA

A. The Fixed IP CCTV Camera to be provided under this Section shall meet, or exceed, the following requirements:

1. The Fixed IP Camera shall be certified by the manufacturer to be fully compatible with the Network Video Recorder specified elsewhere in the section.

2. The Fixed IP Camera shall output multiple video streams using different

codecs simultaneously.

3. The Fixed IP Camera shall stream both H.265 and H.264, minimum.
4. The Fixed IP Camera shall include a Web User Interface.
5. The Fixed IP Camera shall be ONVIF conformant.
6. The Fixed IP Camera shall have enough dynamic range to compensate for the wide range of ambient lighting conditions, including the difference between daylight flooding through vehicle windows and the interior lighting conditions that will be encountered in a marine environment while still providing usable images.
7. The Contractor shall provide and install all required camera mounting brackets, adapters and associated hardware to mount the Fixed IP Cameras at the location(s) as approved by the Authority.
8. The Fixed IP Camera shall stream 60 FPS at 1920 x 1080 with H.265 encoding.
9. The Fixed IP Camera shall simultaneously stream two 15 FPS multicast streams at 1920 x 1080 with H.265 encoding.
10. General Construction
 - a. Impact resistant housing, IK10, minimum
 - b. Low profile housing with a clear polycarbonate dome to protect imager
 - c. Tamper and impact resistant CCTV Camera assembly
11. Electrical
 - a. M12 connector for 100Base-TX Ethernet
 - b. Input voltage: PoE (IEEE 802.3af) Class 1, 3.84 watts at camera; maximum
 - c. Camera shall be fully operational within the Operating Temperature range listed elsewhere in this specification on IEEE 802.3af PoE.
12. Imaging System
 - a. Iris Automatic iris control
 - b. Imaging Sensor: 1/2.8"
 - c. Image Resolution: 1080p (1920 x 1080, 30 FPS), minimum
 - d. Lens: 102-degree horizontal field of view
 - e. Dynamic Range: 120dB
13. Minimum Illumination (No Image Enhancement, AGC On, 30 FPS)

a.	Color:	0.04 Lux (F2.0)
	B&W:	0 Lux (IR LED On)

14. Camera Angle Adjustment: H: 94.8° / V: 49.3° / D: 114.3

15. Dimensions:

a.	Length:	4", max
b.	Width	4", max
c.	Height:	2.25", max

16. The Fixed IP Camera assembly shall meet or exceed the following environmental requirements:

- a. Operating Temperature -22°F to +131°F
- b. Environmental Rating IP66
- c. Compliant with EN50155 Standard

17. Networking Requirements:

- a. The Fixed IP Camera shall include Unicast and Multicast streaming.
- b. The Fixed IP Camera shall support the following protocols: TCP/IP, UDP/IP, IPv4, IPv6, HTTP, HTTPS, Unicast, Multicast (IGMP), UPnP, DNS, DHCP, ARP, FTP, RTP, and NTP.
- c. The Fixed IP Camera shall be password protected.
- d. The Fixed IP Camera shall be fully compatible with the Ethernet Switch, Network Video Recorder, and Genetec.

B. The Contractor is responsible for all Fixed IP Camera setting adjustments to be configured for the location and application. Fixed IP Camera adjustments shall include: pan and tilt orientation, brightness, contrast, saturation, focus, back light compensation, dynamic range, frame rate, and compression.

C7. CAMERA SHROUD

- A. The Contractor shall provide a camera shroud for each of the exterior cameras. The shroud shall protect the exterior cameras from being damaged during normal vessel operation and maintenance, vandalism, etc., without hindering the camera view.
- B. The shroud shall be fabricated from a single sheet of one-sixteenth inch (1/16") thick stainless steel, painted to match the exterior of the vessel.
- C. The shroud shall include pre-drilled holes around the perimeter for fastening hardware.
- D. The shroud shall not have any adhesives, or in any way damage the vessel when removed for camera maintenance.

C8. ONBOARD NETWORK VIDEO RECORDER (NVR) HARDWARE

A. The Onboard Network Video Recorder Hardware and Mobile Network Video Recorder Software shall be selected to complement each other to achieve the requirements included in these specifications and on the Contract Drawings. If a specific feature is not required in this section but is required for the NVR Software to meet the required functions, then that feature shall be included by the Contractor at no additional cost to the contract. If the achievement of the system and software requirements by the software chosen by the Contractor requires an enhancement of any specification, then those enhanced specifications shall be included at no additional cost to the contract.

B. The Onboard NVR shall meet, or exceed, the following specifications:

1. CPU:	Intel i7-7600u, newest version, 2.8GHz, minimum
2. Memory:	32GB DDR3-1600, minimum
3. USB:	(1) USB 2.0, minimum
4. Audio:	(1) Audio Input, minimum
5. Storage:	OS: 128G SATA III, SSD Data: 4TB, 2.5" SATA 6.0Gbps 5400RPM
6. Display Output:	DVI/HDMI/VGA with resolution of 1600x1200
7. Ethernet:	(8) 10/100/1000Base-T with M12 connector
8. Ethernet:	Wireless 802.11a/b/g module
9. 4G Wireless:	Certified Verizon Wireless 4G built-in module
10. Inputs:	(4) Dry Contact, minimum
11. Outputs:	(2) Digital, 200mA maximum
12. Status LEDs:	Power, Storage, LAN
13. Dimensions:	11.5"x11.5"x5", maximum
14. Weight:	15 lbs, maximum
15. Mounting:	Panel
16. Operating Temperature:	-22°F to +122°F
17. Cooling:	Fanless
18. Relative Humidity:	10 to 90% non-condensing
19. Voltage:	12 – 36 VDC
20. Power Consumption:	80 Watts, maximum
18. Standards:	UL 60950-1, EN 50155
19. Operating System:	Windows 10 IoT Enterprise, 64Bit

C. The Onboard NVR shall contain up to two video storage drives installed on trays that can be removed by the user without any dismantling of the Onboard NVR. The video

storage drive trays shall be visible on the front of the Onboard NVR, shall require a vandal proof/tamper proof key be turned on the Onboard NVR prior to drive removal, and, after turning of the key, shall permit the drive tray to be simply pulled to remove the drive. These hard drives can then be placed in a Hard Drive Dock for access to the video. A new drive or drives can then be installed in the Onboard NVR and no other initialization shall be required for the NVR to function upon startup of the vessel. The video storage hard drives shall be sized to record all CCTV Camera views for 170 hours.

D. The Onboard NVR shall include a solid-state storage device that is removable by opening of the Onboard NVR that contains the operating system and the Mobile NVR Software. This solid-state storage device shall not be removed when the video drives are removed for evidentiary research, storage, or other reasons.

C9. MOBILE NVR SOFTWARE

A. The Mobile NVR Software shall be installed on the Onboard Network Video Recorder to record the streams from Fixed IP CCTV Cameras and 360 Degree IP CCTV Cameras. The Mobile NVR Software shall also connect to the NVRs located at the two MBTA Data Centers within Boston, MA and installed on the Stationary Recording Hardware for the purpose of offloading tagged event video, requested video, and equipment status and failures. Events shall be tagged when any selected digital input to the Onboard Network Video Recorder is activated.

B. The NVR software installed on the Stationary Recording Hardware shall allow for the connection of clients on the SWAN to access the video offloaded from any vessel at any time they are on the MBTA SWAN. The software shall also allow the connection of a client on the SWAN to the live and recorded video on any vessel connected to the Fixed Wireless Network. The software shall also allow any client on the SWAN to select a period for any vessel on or off the Fixed Wireless Network for automatic offloading next time the vessel is connected to the Fixed Wireless Network. The clients shall also be able to check the health status of any Onboard NVR connected or disconnected from the Fixed Wireless Network. The client software shall alert the user of any critical Onboard NVR problems upon login.

C. The Mobile NVR Software shall record the streams from all cameras using H.265 at 10FPS, for seven days and overwrite the oldest data when full.

D. The Mobile NVR Software shall also be capable of recording the audio stream along with any video stream from a camera.

E. When the vessel enters the harbor and connects to the Fixed Wireless Network, the video from any tagged events and any video requested by a client on the MBTA SWAN shall be offloaded from the Onboard NVR. If the wireless connection is interrupted, then offload shall halt and continue without error upon reconnection to the Fixed Wireless Network.

F. The Mobile NVR Software shall operate on a First In, First Out manner; the first video recorded shall be the first overwritten once the hard drives are full.

G. On ignition, the Mobile Closed-Circuit Television System shall activate. The NVR

shall be fully booted and active with two (2) minutes of ignition. The Onboard NVR shall begin recording video once it has fully booted. On loss of ignition, the Mobile Closed-Circuit Television System shall remain active for nine (9) minutes. The Onboard NVR shall continue to record cameras for these nine (9) minutes, and, if a connection to the fixed Wireless Network is active, shall offload video. After nine (9) minutes, all components shall shut down unless the ignition is again turned on prior to shut down.

C10. DIAGNOSTIC MONITORING

- A. The Contractor shall include a method of performing remote diagnostic testing of the Onboard Network Video Recorder, Onboard Cameras, Onboard PoE Switch, and Onboard Wireless Access Point. The tool shall include the date, time, health status, GPS location, vehicle location, last status, clock sync and system versioning information. This includes all tools and instructions for performing the diagnostics.
- B. The Contractor's tool shall provide a method to remotely view all diagnostic information related to the Onboard CCTV Systems in real time when available.
- C. The Contractor shall include in the tool a means for remotely rebooting or resetting all components of the Onboard CCTV system.
- D. Each Vessel in the tool shall contain a camera list, systems health checks and reboot options and be included in a tree format.
- E. On booting, the Onboard NVR shall display diagnostic information on the Onboard Hardened 19" LCD Monitors when booting including but not limited to:
 - 1. The status and condition of the RAM
 - 2. The status and condition of the Hard Drives
 - 3. The status of the cameras
 - 4. The network status

C11. TRI-COLOR REMOTE LED INDICATOR LIGHT

- A. The LMR-400 Antenna Cable shall be used to connect the Wireless Antenna to the 4G LTE Gateway and Mobile Wireless Access Point. The LMR-400 Antenna Cable shall be designed for outdoor marine environments and be watertight. The Tri-Color Remote LED Indicator Light shall be installed in the driver side dash panel and will show no color when the NVR is off, Red while the NVR is booting and when there is trouble, Amber when the NVR recording, but one or more cameras are defective, and Green when the system is operational, and all the cameras are recording.
- B. The Tri-Color LED Indicator Light shall meet, or exceed, the following specifications:
 - 1. Colors: Green, Red, Amber (Amber created by the energizing of both the red and green diodes)
 - 2. Voltage: 24VDC, or as required by the NVR

3.	Operating Temperature:	-67°F to +158°F
4.	Environmental Rating:	IP67
5.	Enclosure Material:	Black Chrome-Plated Brass
6.	Dimensions:	42mm length, 9.5mm diameter reflector face
7.	Mounting:	Stainless Steel Panel Mount
8.	Mounting Hole:	8mm

C12. ONBOARD WIRELESS MODULE

- A. The NVR shall have a wireless card installed in each unit and will allow each vessel NVR to automatically connect to the Fixed Wireless Network in client mode when in range in order to offload diagnostic information and tagged or requested video. All data shall pass to the SWAN over the Onboard Wireless card to the Fixed Wireless Network when the vessel is within range of the Fixed Wireless Network. The Onboard Wireless shall transmit utilizing multiple spatial streams and a MIMO antenna system.
- B. The Onboard wireless shall meet, or exceed, the following specifications:
 - 1. Standards: 802.11a/b/g/n/ac, 802.11i, 802.3af
 - 2. Wireless Throughput: Up to 1300 Mbps
 - 3. Antenna Connections: Two (minimum)
 - 4. Operating Frequency: 5.2 to 5.8 GHz, all channels
 - 5. Security: MAC, IP, Protocol, and Port based filtering
 - 6. Ethernet Connector: 10/100/1000Base-T M12
 - 7. Status LEDs: WLAN, LAN, Power
- C. The Onboard Wireless Access Point shall include an embedded GPS Receiver with high sensitivity using the NMEA protocol. The Onboard Wireless Access Point shall allow connections to be made to request GPS location of the vehicle via the cellular network and wireless network.

C13. ONBOARD 4G LTE MODULE

- A. The Onboard 4G LTE shall provide the MBTA Operators access to live video from the MBTA Ferries via the Verizon 4G LTE Wireless Network when they are traveling throughout the waterways. The Onboard module can also be integrated together with the Onboard WAP. Data shall only pass to the MBTA SWAN via the Onboard 4G LTE on an as needed basis or when live video is requested by an MBTA Operator. Video offload will first attempt Onboard Wireless, if the WIFI is not available the Onboard 4G LTE shall offload the video. The Contractor shall activate Verizon 4G LTE service on five Ferries selected by the MBTA for two years with unlimited data paid for by the Contract; the Contractor is responsible for all coordination and configuration in coordination with the MBTA IT Department.
- B. The Onboard 4G LTE module shall meet, or exceed, the following specifications:

1. Security Features:	Onboard IPsec SSL VPN Client, VPN Pass-Through, GRE Tunneling, MAC Address Filtering, IP Filtering, Port Filtering, SSH, HTTPS
2. Bands:	LTE @ 700MHz, CDMA/EV-DO @ 800 and 1900 MHz
3. 4G Interface:	M2, PCI, PCIe or another standard mechanical interface
4. LTE Antenna Interface:	Two SMA connections (minimum)
5. Certifications:	Verizon Wireless

C14. ONBOARD POE SWITCH

- A. The Onboard PoE Switch shall be installed on the vessel to connect to the CCTV Cameras, Onboard Wireless Access Point, Onboard Network Video Recorder, and any other equipment that needs to communicate via Ethernet. The Onboard PoE Switch shall also provide PoE Power to the CCTV Cameras.
- B. The Onboard PoE Switch installed under this section shall meet or exceed the following criteria:
 1. The Onboard POE Switch ports shall include the following. (The Contractor shall include additional ports as necessary for a fully functional system based on chosen system components.)
 - a. Minimum (8) auto sensing 10/100 PoE ports
 - b. Minimum (2) auto sensing 10/100 non-PoE ports
 - c. Connector: M12
 2. The Onboard POE Switch shall meet the following environmental requirements:
 - a. -40°C to +75°C
 - b. Operating relative humidity: 5% to 95% non-condensing
 3. The Onboard POE Switch shall meet the following electrical requirements:
 - a. Voltage: 24 VDC
 4. The Onboard POE Switch shall comply with the following standards:
 - a. UL 508
 - b. EN 50155
 5. The Onboard POE Switch shall meet HTML and Telnet management standards
 6. The Onboard POE Switch shall meet SNMP v1/v2/v3 network management standards
 7. The Onboard POE Switch shall use the following IP Multicast Standards:
 - a. IGMPv1, IGMPv2
 8. The Onboard POE Switch shall have the following security features:
 - a. IEEE 802.1X Port Based Network Access Control
 - b. TACACS+

- c. SSH
- 9. The Onboard POE Switch shall meet, or exceed, the following protocols and industry standards:
 - a. IEEE 802.3af Power over Ethernet
 - b. IEEE 802.1p Priority
 - c. IEEE 802.1Q VLANs
 - d. IEEE 802.1w Rapid Reconfiguration of Spanning Tree
 - e. IEEE 802.3 10BaseT
 - f. IEEE 802.3u 100BaseT(X)
 - g. IEEE 802.3ab 1000BaseT(X)
 - h. IEEE 802.3x Flow Control
- 10. Mounting: Panel Mount
- 11. Maximum Dimensions: 7" width x 7" height x 5" depth
- 12. Warranty: 5 Years

C15. ONBOARD WIRELESS ANTENNA

- A. An Onboard Wireless Antenna shall be a multi-band, MIMO, multi-element antenna system, under a single radome. The antenna shall be designed for vehicular applications and be connected to the Onboard Wireless Access Point and the Onboard 4G LTE gateway, to transmit and receive wireless signals from the Fixed Wireless Network, a 4G cellular network, and MBTA Police Mobile Data Terminals. The antenna shall also have an element for GPS. The Onboard Wireless Antenna shall have sufficient cable whips with low loss cable to reach from the installation location to the location of the Onboard Wireless Access Point and Onboard 4G LTE Gateway.
- B. The Onboard Wireless Antenna shall meet or exceed the following specifications:
 - 1. Frequency Range (Voice/Data): 698-2500MHz and 3300-3800MHz
 - 2. Frequency Range (Wireless): 1.7-2.8 GHz and 4.9-5.9 GHz
 - 3. Frequency Range (GPS): 1575.42 MHz
 - 4. Antenna Gain (Voice/Data): 1-2 dBi at 698-2500MHz and 2-3 dBi at 3300-3800MHz
 - 5. Antenna Gain (Wireless): 2-3 dBi at 1.7-2.8 GHz and 3-4 dBi at 4.9-5.9 Ghz
 - 6. Number of Elements: Five (minimum)
 - 7. Polarization: Linear, Vertical
 - 8. Impedance: 50 Ohms
 - 9. Input Power: 50 Watts, max
 - 10. Radome: Black, UV Protected
 - 11. Operating Temperature: -40°C to +85°C

12. Connectors:	SMA Plug
13. Standards:	IP67 Compliant

C16. ONBOARD HARDENED 21" LCD MONITORS

- A. A Hardened 21" LCD Monitor shall be installed in the Pilothouse for use by the ship's crew and shall use the Operator NVR software to cycle through all live CCTV Cameras views listed in Section 440, with the exception of the pilothouse navigation view, the pilothouse inward facing camera, and the back-up camera view. Images shall be displayed on a split screen of four images at a time. Grouping of images shall be Authority-approved. This cycling through of the camera views shall automatically launch after boot-up of the NVR. The backup camera shall be shown only when the vessel is moving astern and shall replace all other images with a full screen view.
- B. The CONTRACTOR shall, utilizing tamper proof hardware, mount the Hardened 21" LCD Monitor as shown on the Contract Drawings. Route all cabling and connectors such that they are not exposed.
- C. The Onboard Hardened 21" LCD Monitors shall meet, or exceed, the following specifications:
 - 1. LCD Monitor Size 21" Diagonal display
 - 2. Display Input HDMI, DVI, or Ethernet (compatible with NVR) with resolution of 1920x1080
 - 3. Aspect Ratio 16:9
 - 4. Response Rate 5ms, maximum
 - 5. Power Consumption 25 Watts, maximum
 - 6. Voltage Compatible with vessel's power system
 - 7. Enclosure Depth 2.4" maximum
 - 8. Viewing Angle (Hor/Vert) 170° / 160°
 - 9. Temperature Rating -10°C to 85°C
 - 10. Shock/Vibration rating Mil-Spec 810 or equivalent as determined by Engineer, minimum
 - 11. Enclosure Ratings: NEMA 4X, IP66
 - 12. Enclosure Material: Stainless Steel
 - 13. Screen Material: Safety Glass
 - 14. Mounting: Submit mounting location and style to the MBTA for approval
 - 15. Standards: UL 60950, UL 508A

C17. ONBOARD UPS

- A. An onboard UPS shall be installed to power the onboard NVR, onboard Wireless Access Point, and onboard PoE Switch. The onboard UPS shall be designed to filter

power to attached devices and provide backup power when the vessel is powered down.

1. Maximum Output: 15 Amps
2. Output Voltage: As needed for equipment
3. Backup Time: 15 Minutes @ 8 Amps, 8 Minutes @ 12 Amps
4. Battery Amp-Hour Rating: 5 (or greater, as required for backup time)
5. Battery Life: 5 Years
6. Voltage Spike Protection: 4,000 Amps, 100 Joules
7. Indicator Lights: LED to indicate status of input and output power

B. The onboard UPS shall include protection circuitry to avoid complete discharge of the battery.

C18. TERMINAL BLOCKS AND POWER WIRING

- A. All power wiring shall be 14 AWG, stranded wire suitable for seafaring vessel installation.
- B. Terminal Blocks shall be designed for use on moving vehicles and shall be used for connections of power and control wiring on the vessel.
- C. Terminal Blocks shall be DIN rail mounted.
- D. Provide DIN rails and end panels for each group of terminal blocks.
- E. All Terminal Blocks shall meet, or exceed, the following specifications:
 1. Dimensions: 0.25" x 2" x 1.5" maximum
 2. Maximum Load Current: 31 Amps
 3. Pollution Degree: 3
 4. Nominal Voltage: 800 Volts
 5. Nominal Current: 24 Amps
 6. Conductor Cross Section: 12-28 AWG
 7. Connection Type: Spring Cage
 8. Standards: Approved for use on seafaring vessels
 9. Temperature Rating: -50°C to +110°C

C19. ONBOARD CATEGORY 6 (CAT6) CABLE

- A. All Onboard CAT6 shall be shielded and suitable for indoor/outdoor use. The cable shall be rated for wet locations.
- B. All Onboard CAT6 network cabling and connections shall be labeled at each end. All labels shall be shown on submitted shop drawings for type, location and service.

- C. All ferry CAT6 cables and components installed shall comply with the following:
 - 1. All CAT6 network cabling systems shall have EIA/TIA 568B Series standard pin/pair termination assignment. All conductors provided shall be properly and consistently terminated at both ends throughout the entire system. All Shields shall be connected on the equipment side only to facilitate proper grounding and drain.
 - 2. ANSI/TIA/EIA-568-B.2-1
 - 3. IEEE 802.3af DTE Power and MDI Verified
 - 4. IEEE 802.ab Gigabit Ethernet Verified
 - 5. ETL Verified
 - 6. FCC part 68.5, subpart F compliant
 - 7. ISO 11801 2nd Edition, Class E Compliant
- D. Cable Physical Characteristics:

1. Jacket:	Polyolefin
2. Jacket Color:	Yellow
3. Insulation:	Polyolefin
4. Conductors:	#24 AWG Solid Bare Copper, or greater
5. Shielding:	Aluminum/Polyester with 100% coverage
6. Composition:	4 Pair, STP with Core Separator
7. Operating Temperature:	-14°F to 167°F
8. Cable O.D. (Max):	0.25 inches
9. Voltage Rating:	300 Volts RMS
10. Flame Tests:	UL1581 and UL1685

C20. M12 END CONNECTORS

- A. M12 End Connectors shall be used to terminate Onboard Cat6 Cables for connections to CCTV Cameras, Onboard NVRs, Onboard PoE Switches, and any other Ethernet Connected Device.
- B. The M12 End Connectors shall be designed to terminate the Onboard Cat6 cables.
- C. The M12 End Connectors shall be a screw connections type for connection to the devices.
- D. The M12 End Connectors shall have an operating temperature of -40°F to 185°F.
- E. The M12 End Connectors shall be coded to match the devices they are attaching to for proper alignment of the connector.

C21. IP CCTV CAMERA SIGNAGE

- A. The IP CCTV Camera Signage shall be installed on each vessel to alert the public that there are CCTV cameras recording on the vessel. Signs shall be installed plumb, with no air bubbles.
- B. The IP CCTV Camera Signage shall meet, or exceed, the following specifications:
 - 1. Coloring: Black letters on white background

2. Mounting:	Adhesive backed
3. Adhesive:	-40°F to 140°F, outdoor rated
4. Dimensions:	11" x 8"

C22. WORKSTATION INTERFACES AND SOFTWARE

- A. Certain features of the system shall be functional through both the NVR native client and the Genetec Security Center client. Administration and configuration features of the system are only required to be accessible from the NVR native client.
- B. The live video streaming from the vessel, the recorded video stored on a vessel, and the recorded video stored on MBTA Central storage shall be available for viewing through Genetec Security Desk. If the NVR is connected to the WiFi network or has 4G LTE activated and is connected to the 4G LTE network, then the live video and the recorded video stored on the vessel shall be accessible.
 - 1. In Genetec, if the user selects a camera for viewing that is not connected to the 4G LTE network or the WiFi network then it shall be reported to the user that the live video and the video stored on the vessel is not accessible, and still allow the user to access video that is stored on the Stationary Recording Hardware. If the user is viewing a camera on an NVR connected to the WiFi or 4G LTE network and the NVR disconnects from the network, then it shall be reported to the user that the video is no longer available for viewing due to the NVR disconnecting.
 - 2. The NVR native client shall graphically show which cameras are connected to or disconnected from the network and shall not allow the user to try to connect to live video or recorded video stored on a vessel, but still allow the user to access recorded video stored on the Stationary Recording Hardware.
- C. Any critical alarm including, but not limited to, hard drive failures, failure to connect to the network for 24 hours, power failures, and RAM failure shall be reported from the software to Genetec for alarming. In the case of a vessel with an active 4G LTE connection, alarms shall also be configurable if a system is offline for lesser periods of time. The software shall only issue one alarm through Genetec for a single event.
- D. From the NVR's Genetec System, the user shall have the ability to request time periods of video for offloading from the Mobile NVRs on the Ferries next entry onto the WiFi network. The selection of video shall not require the Mobile NVR to actively be connected to the network to initiate this request.
 - 1. When making a request for time periods of video to be offloaded, the person making the request shall have the option of entering their email address. Once the video is retrieved, the person making the request shall receive an email stating that the request has been fulfilled with the vessel number and the time and date range of the request.
 - 2. The application shall give at least three statuses for requested video:
 - a. Sending of the request to the system is pending
 - b. Request received by the system and awaiting fulfillment
 - c. Request has been fulfilled

E. The NVR native client shall allow the user to view the health status of all NVRs including any critical errors or warnings and the last time any NVR connected to the system. Critical error and warnings shall also be selectable for emailing to selected persons or groups.

C23. LOCKABLE NVR BOX

A. The Lockable NVR Box shall be used to house the Onboard Network Video Recorder and protect it from tampering. The Lockable NVR Box can also be an integral part of the Onboard NVR Hardware if it results in the intended functionality.

B. The Lockable NVR Box shall meet, or exceed, the following specifications:

1. Material:	Brushed aluminum
2. Material Thickness:	1/8", minimum
3. Mounting:	The Lockable NVR Box shall mount securely to the shelf, and the Onboard NVR shall mount securely to the Lockable NVR Box.
4. Size:	Appropriately sized to allow the Onboard NVR to fit, connections to be made, and the Onboard NVR to cool properly
5. Vents:	Shall include sufficient vents or alignment of heat transfer fins or sinks to allow proper heat transfer
6. Cable Entries:	Shall include grommets and shall be sized appropriately for cables
7. Locks:	Tamper resistant, all keyed alike
8. Keys:	Include one key per box

APPENDIX D: DEADWEIGHT SURVEY – MV LIGHTNING

APPENDIX E: CONTRACT DELIVERABLE REQUIREMENTS LIST (CDRL)

CDRL	Section	Description	Due
CDRL 003-1	003.3.2	Stability Letter	Prior to Vessel Delivery
CDRL 003-2	003.3.2	FCC Documents	Prior to Vessel Delivery
CDRL 003-3	003.3.2	Fire Safety Instructions	Prior to Vessel Delivery
CDRL 003-4	003.3.2	Compass Deviation Card	Prior to Vessel Delivery
CDRL 003-5	003.3.2	MARPOL Placard	Prior to Vessel Delivery
CDRL 003-6	003.3.2	Emergency Evacuation Plan	Prior to Vessel Delivery
CDRL 004-1	004.4	ADA/PVAG compliance drawings	NTP + 90 days
CDRL 005-1	005	Drawing, Correspondence and Communication Procedures	NTP + 30 days
CDRL 006-1	006.3	Master List of all contract drawings (initial submittal)	NTP + 30 days
CDRL 006-2	006.5.1	Inform MBTA of Contractor's point of contact	NTP + 10 days
CDRL 006-3	006.6	As-Built Drawing Package	Vessel Delivery + 30 days
CDRL 006-4	006.7	Vendor equipment information - 5 copies	Vessel Delivery - 10 days
CDRL 006-5	006.7	Maintenance Instructions	Vessel Delivery - 30 days
CDRL 006-6	006.7	Operator's Manual	Vessel Delivery - 30 days
CDRL 006-7	006.8	Vessel History Book	Vessel Delivery
CDRL 006-8	006.9	Photographic Record, final copy	Vessel Delivery
CDRL 006-9	006.10	Master Construction Schedule	NTP + 30 days
CDRL 006-10	006.11	Equipment List	Vessel Delivery
CDRL 008-1	008	Weight, Center of Gravity & Freeboard Report Format	NTP + 30 days
CDRL 008-2	008	Comparison of completed Weight Estimate to Weight Survey Report	Prior to Vessel Delivery
CDRL 011-1	011.6	Maintainability Demonstration Plan	NTP + 90 days
CDRL 011-2	011.6	Maintainability Demonstration	Vessel Delivery - 30 days
CDRL 018-1	018.2.1	Quality Manual	NTP + 30 days

CDRL	Section	Description	Due
CDRL 018-2	018.2.1	Project Quality Plan	NTP + 60 days
CDRL 018-3	018.3.3	Contractor's Organization Chart	NTP + 30 days
CDRL 018-4	018.3.5	Name of System Integrator	NTP + 30 days
CDRL 018-5	018.4.3	Specification data sheets for new or modified consumables	NTP + 210 days
CDRL 018-6	018.4.4	Manufacturing Plan Flow Chart	NTP + 30 days
CDRL 018-7	018.5	Project Inspection Plan	NTP + 60 days
CDRL 020-01	020.1	Name and Qualifications of Operator Training Instructor	Vessel Delivery - 30 days
CDRL 020-02	020.1	Operator Training	Within 7 days of Vessel Delivery
CDRL 020-3	020.2	Name and Qualifications of Maintenance Training Instructor	Vessel Delivery - 30 days
CDRL 020-4	020.2	Operator Training	Within 7 days of Vessel Delivery
CDRL 021-1	021.1	Laptop PTUs - 2	Vessel Delivery
CDRL 021-2	021.1	Listing of Systems or subsystems requiring PTUs	NTP + 180 days
CDRL 021-3	021.2	Special Tools & Fixtures - 2 sets	Vessel Delivery
CDRL 023-1	023	Freeze Protection Plan	NTP + 30 days
CDRL 102-1	102	Hazmat Survey Report	NTP + 90 days
CDRL 110-1	110	Hull Repair Plan	with submittal to USCG
CDRL 435-1	435	Equipment required for recording and modification of visual and audible passenger information messages. (1 set per vessel)	Vessel Delivery - 30 days
CDRL 631-1	631.5	Exterior Coating & Styling Scheme	NTP + 180 days
CDRL 631-2	631.5	Interior Coating & Styling Scheme	NTP + 180 days
CDRL 631-3	631.5	Paint samples - 3 sets	NTP + 180 days
CDRL 645-1	645.2.1	Seat upholstery & frame finish samples	NTP + 180 days
CDRL 903-1	903.1	Pre-Overhaul Speed Trial Results	within 5 business days of trial
CDRL 903-2	903.2	Thermal infrared survey - MV Lightning	Prior to hull repair plan

CDRL	Section	Description	Due
CDRL 903-3	903.3	Pre-Overhaul Sound and Vibration Test Report	within 5 business days of trial
CDRL 906-1	906	Documentation of Credit Drydocking	Prior to Vessel Delivery
CDRL 981-1	981.1	Deadweight Survey Report	Prior to Vessel Delivery
CDRL 982-1	982.2	Test & Inspection Plan	Trials - 30 days
CDRL 982-2	982.4	Test & Inspection Reports	Prior to Vessel Delivery
CDRL 987-1	987	Shipment & Delivery Plan	Prior to vessel shipment

APPENDIX F: MAIN ENGINE OVERHAUL SPECIFICATION

F1.00 OVERHAUL REQUIREMENTS

This Specification covers the scope of work and material requirements for overhauling MTU Model 12V 2000 M70 marine engines installed in the Authority's high-speed catamaran ferries M/V Flying Cloud and M/V Lightning.

The Contractor shall perform all the work involved in the disassembly, cleaning, inspection, qualification and repair or replacement of component parts, reassembly, and preparation and testing of the engine in accordance with the following provisions.

F1.01 GENERAL

1. Work shall be performed by a certified MTU repair facility using MTU factory trained mechanics.
2. The engine is to be completely dismantled to accommodate the thorough cleaning of all components, before actual qualification and overhaul operations commence.
3. Component cleanliness must be maintained throughout the overhaul cycle.
4. Procedures and activities shall be in accordance with MTU recommended practices and work instructions, specifically including the Technical Publication M050629/03E, Service Manual 6SE2000 9908 and all applicable documents referenced therein.
 - a. Overhauling/requalification of engine components, and all necessary repair work, must be in accordance with OEM recommended specifications, except as may otherwise be directed by this Specification.
5. All components, replacement parts, reused parts and other materials shall be in accordance with MTU requirements unless otherwise specified or approved by the Authority.
6. The Contractor shall take a comprehensive set of photographs during the overhaul process through final assembly and testing. Particular attention shall be given to defective parts and conditions found.

F1.02 EMISSIONS

1. The Contractor shall utilize replacement parts and procedures as required so that the completed engines as installed in the vessels will be in compliance with EPA Tier 2 requirements for exhaust emissions in accordance with 40 CFR 92 regulations.
 - a. Procedures shall include any testing necessary to demonstrate and achieve EPA compliance.

- b. The Contractor shall provide to the Authority an EPA certification that the vessels are in compliance when delivered.

F1.03 SPECIFIC COMPONENT REQUIREMENTS

1. After the disassembly, cleaning and inspection of the engine, the Contractor shall advise of any required additional repairs and part replacements not included in this base specification. All parts in need of replacement shall be retained for inspection/evaluation by MBTA.
2. The engine block and components shall be inspected and measured to verify compliance with MTU specifications.
3. At a minimum the engine overhaul shall include the following new items:
 - a. Cylinder liners and liner seals
 - b. Pistons, rings and piston pins
 - c. Cylinder heads, including valves and valve springs
 - d. Connecting rods
 - e. Main and connecting rod bearings
 - f. Electronic unit pumps
 - g. Camshaft bearings
 - h. Cam followers (roller tappets)
 - i. Rocker arm assemblies
 - j. Fuel injector nozzles and all high-pressure fuel lines
 - k. Turbocharger
 - l. Crankshaft vibration damper
 - m. Exhaust flow control flap bearing
 - n. Belts and hoses
 - o. All engine filters
 - p. Engine oil pump, including pick-up tube assembly
 - q. Coolant pump

- r. Salt water pump
- s. Intercooler and coolant tube assembly
- t. All engine cooling system piping and flexible hosing on engine and its interface with the sea chests
- u. Heat exchangers
- v. Block heater elements
- w. Fuel delivery pump
- x. Fuel pressure maintaining valve
- y. Thermostats
- z. Starter
 - aa. Alternator and belt tensioner
 - bb. All elastomeric parts and seals, including front and rear seals
 - cc. All engine mounted electrical switches and sensors
 - dd. New replacement engine wiring harness and control harness
 - ee. Hardware

4. The crankshaft and camshaft shall be inspected to verify their qualification for reinstallation in the engine. If suitable for reuse, they shall be measured and polished.
5. Gears shall be inspected for scoring, pitting and excessive backlash. Timing gear bushings shall be replaced with new.
6. All other engine parts, especially castings and/or forgings, shall be inspected and re-qualified to assure they are within MTU standards for reinstallation.
7. A dirty oil suction-off arrangement shall be added to the engines in compliance with OEM recommendations and USCG regulations. The overhauled engines shall include a ball valve at the sump connection to which a flexible hose (USCG approved for lube oil service) can be attached for access at a convenient location above the engine room floor plates. A ball valve, quick-connect cam-lock fitting, and cap or plug shall be provided at the discharge end. The discharge end and fittings shall be securely attached to structure and arranged for ease of connection to a shore side suction-off hose.

F1.04 FINAL ASSEMBLY

8. After completion of testing the engine shall be properly primed and painted in MTU's standard blue color.
9. Any component that would be damaged or suffer impaired performance from painting shall be masked and left unpainted. These items include, but are not limited to the following:
 - a. Wire, cable, flexible conduits and fittings, electrical grounding points.
 - b. Wearing surfaces, threads used for adjustments, lubrication points.
 - c. Elastomeric parts, hoses, bumpers, etc.
 - d. Heat transfer surfaces, resistors, electrical insulators, etc.
 - e. Moving parts such as linkage joints, gas spring piston rods, etc.
10. A separate rebuilder's ID plate shall be attached to the engine beside the original builder's serial number ID plate. The rebuilder's ID plate shall document only the rebuilders name and the date of completion (month and year) of the overhaul.

F2.00 ENGINE TESTING AND DELIVERY

1. Prior to remanufacture of the engines, the rebuilder shall perform a dynamometer test of the engines to determine the pre-overhaul performance.
2. After all assembly work is complete, the overhauled engine will be charged with fresh lubricating oil and coolant and shall be dynamometer tested at the Contract Operator's facility to verify that its performance is within the criteria established by MTU for a remanufactured engine and no less than its pre-remanufacture performance. A 2-hour full power test shall also be performed to verify satisfactory performance in continuous operation.
3. Test and Inspection Requirements:
 - a. Test procedures and performance criteria shall be submitted to the Authority for review at least 30 days prior to performance of the test.
 - b. Contractor shall be responsible for ensuring that the Authority is given adequate notice (minimum 1 week) of testing to allow attendance by the Authority or its representative.
 - c. The rebuilder shall provide opportunities for the Authority or the Authority's representative to inspect all critical and/or hidden areas prior to their closure or covering.

4. After final assembly and testing the engine shall be properly prepared to ensure that no damage occurs during shipment. This shall include shrink wrapping or other method of covering of the engine to protect it during shipping.

END OF SECTION

APPENDIX G: WATERJET OVERHAUL SPECIFICATION

G1.00 GENERAL

The Contractor shall inspect and remove waterjets and components, dismantle, crate and properly protect the waterjets for transport. Impeller housings shall be removed, and the inlet tunnels shall be inspected for wear or damage.

Contractor shall contract an MJP certified shop to rebuild the waterjets according to the original equipment manufacturer's (OEM's) specifications and recommendations to a like-new condition. All replacement parts shall be OEM. Contractor shall be responsible for all transportation to and from the rebuild shop as well as all costs for the rebuild. Unanticipated repairs and replacement parts which are not covered in the standard overhaul work items as specified and per OEM recommendations shall be addressed by Change Order.

G2.00 REBUILD

All waterjet components and parts shall be inspected for damage or maintenance neglect and overhauled, repaired, or replaced per OEM recommendations to bring the units to a like-new condition. A full list of all replacement parts shall be provided to the Authority. The Contractor shall advise of any required additional repairs or replacements to the items listed below. All parts in need of replacement shall be retained for inspection/evaluation by the Authority.

1. **Hub Units** – Hub units shall be inspected and overhauled per OEM recommendations. This shall include replacement of mechanical seals, bearings, etc.
2. **Impellers** – Impellers shall be inspected, balance, and repair as required.
3. **Wear items** – All wear items, such as bushings, pins, hardware as well as all gaskets shall be replaced with new, OEM parts.
4. **Hydraulic Hoses** – All hydraulic hoses, fittings and sensors shall be replaced with new, OEM parts.
5. **Feedback Sensors** - Feedback sensors shall be upgraded to non-contact type for improved reliability and integration with the steering control system described in Section 568.
6. **Steering Rams** – Steering rams shall be inspected and verified to be in good working order. Potentiometers shall be replaced with new units to match new control system specified in Section 568.

G3.00 REINSTALLATION

The rebuilt waterjet assemblies shall be reinstalled into the vessels per OEM recommendations. Hydraulic lines and hoses shall be connected, and hydraulic fluid refilled. The waterjets shall be integrated with the new steering control system provided per Section 568. Waterjets shall be aligned per MJP alignment specification.

G4.00 CONTROL SYSTEM

The waterjets and associated equipment will be integrated with a new maneuvering and control system described in Section 568. Contractor will be responsible for the integration of the waterjets and the new maneuvering and control system.

G5.00 FINAL ALIGNMENT AND COMMISSIONING

Final alignment shall take place after floating the vessel and prior to engine start-up and Dock Trials. Alignment procedures shall be presented to the Authority and the waterjet manufacturer's Tech Rep prior to the completion of shaft line component installations.

MJP technical support as well as technical support from the steering control system shall be present at the start up, dock trials, and sea trials of the waterjets.

END OF SECTION

APPENDIX H: BRIDGE PLATE SAMPLE DESIGN

